DRAFT
SITE-SPECIFIC TECHNICAL REPORT FOR THE EVALUATION OF THERMATRIX GS SERIES FLAMELESS THERMAL OXIDIZER FOR OFF-GAS TREATMENT OF SOIL VAPORS WITH VOLATILE ORGANIC COMPOUNDS AT SITE FT-002, PLATTSBURGH AIR FORCE BASE, NEW YORK

MAY 1997

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)
TECHNOLOGY TRANSFER DIVISION

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SITE-SPECIFIC TECHNICAL REPORT FOR THE EVALUATION OF THERMATRIX GS SERIES FLAMELESS THERMAL OXIDIZER FOR OFF-GAS TREATMENT OF SOIL VAPORS WITH VOLATILE ORGANIC COMPOUNDS AT SITE FT-002 PLATTSBURGH AIR FORCE BASE, NEW YORK

May 1997

by

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PARSONS ENGINEERING SCIENCE, INC.

DENVER, COLORADO

for

US AIR FORCE

CENTER FOR ENVIRONMENTAL EXCELLENCE

BROOKS AIR FORCE BASE, TEXAS

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PREFACE

Parsons Engineering Science, Inc. (Parsons ES) was contracted by the Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division (ERT) to perform a technology demonstration of the Thermatrix, Inc. GS Series Flameless Thermal Oxidizer at Site FT-002, Plattsburgh Air Force Base, New York. The work was performed for AFCEE/ERT under Contract F41624-94-D-8136, Delivery Order 28.

Key AFCEE/ERT personnel:

Jim Gonzales - Project Manager

Key Parsons ES personnel:

Steven R. Archabal - Site Manager

Douglas C. Downey - Technical Director

Peter R .Guest - Project Manager

1.0 INTRODUCTION

The Air Force Center for Environmental Excellence (AFCEE) has sponsored an ongoing program to promote the use of cost-effective soil vapor treatment technologies to be used in conjunction with soil vapor extraction (SVE) for remediation of fuel- and solvent-impacted sites. On September 20, 1995, Parsons Engineering Science, Inc. (Parsons ES) received formal notice-to-proceed from HSD/PKVDA at Brooks Air Force Base (AFB) under Contract F41624-94-D-8136, Delivery Order 28 to implement a statement of work (SOW) that outlines requirements to provide services that will support environmental air conformity through evaluation of the flameless thermal oxidation (FTO) vapor-phase treatment technology for off-gas abatement at various Air Force base sites worldwide. Thermatrix, Inc. (Thermatrix) of Knoxville, Tennessee is a directed subcontractor to provide the FTO treatment system to be evaluated during the demonstrations. Thermatrix was selected in the Broad Agency Announcement (BAA) for Technology Demonstration for technology evaluation and cost performance of their GS Series FTO system. A technology demonstration was designed by Parsons ES to determine the applicability of using FTO technology for treatment of extracted soil vapors containing chlorinated and non-chlorinated volatile organic compounds (VOCs). Four Air Force installations were identified for demonstrating the FTO system, including a former fire training area (Site FT-002) at Plattsburgh AFB, New York.

1.1 Purpose and Scope

The SVE and vapor-phase treatment demonstration was performed at Plattsburgh AFB, New York, Site FT-002, from August 27, 1996 through March 25, 1997. The technology demonstration was conducted over a 30-week period, and soil vapors were extracted from 14 site wells. The FTO system was tested using individual wells, or pairs of wells for a period of up to 2 weeks per well (or well pair) to determine the optimum vacuum/extraction flow rate balance among all wells and soil vapor concentrations from each of the wells. The 30-week demonstration served two primary purposes: 1) evaluation of the FTO technology, and 2) collection of test data to support the design and operation of a full-scale SVE system that was installed at Site FT-002 by OHM Remediation Services, Inc. (OHM) in 1996.

The FTO technology demonstration was performed in accordance with the *Final Work Plan for the Evaluation of Flameless Thermal Oxidation at Plattsburgh Air Force Base* (the work plan) (Parsons ES, 1996a), and the Addendum to the FTO work plan (Parsons ES, 1996c). The purpose of the site-specific technical report is to evaluate the effectiveness of the FTO system during the Site FT-002 field demonstration and to summarize FTO system performance, operational costs and reliability, and evaluate full-scale treatment system application for the site FT-002.

1.2 Site Background

Site FT-002 is located in northwest corner of Plattsburgh AFB. The site is a former fire protection training area that was used from the mid to late 1950's through 1989, when it was closed to dedicated fire training activities. Training activities involved the release of waste fuels and solvents into unlined pits, where the fuels were ignited and extinguished. Uncombusted fuels and solvents percolated into the soils, resulting in contamination of soils and groundwater.

Several site investigations have been conducted at Site FT-002, under the Air Force Installation Restoration Program (IRP), to characterize soil and groundwater contamination. Detailed descriptions of the nature and extent of site contaminants are provided in the work plan (Parson ES, 1996a).

The results of previous investigations indicate that soil and groundwater at and downgradient from the FT-002 fire training area are impacted with JP-4 jet fuel compounds and chlorinated solvents.

A full-scale SVE system was designed by OHM, the primary remedial action contractor for Plattsburgh AFB. The full-scale SVE system was installed during 1996 and includes vapor extraction/vent wells (VE/VWs), a vacuum blower, and ancillary equipment. The VE/VWs have provided the source hydrocarbon vapors for testing the FTO system.

1.3 Report Organization

This document is organized into five sections, including this introduction, and three appendices. Section 2 presents a description of the FTO technology, vendor's statement of capabilities, and regulatory acceptance. Section 3 describes the field demonstration results including soil vapor concentrations and vapor extraction rates and performance of the FTO system. Section 4 describes full-scale design considerations and presents a cost comparison between various vapor treatment technologies. Section 5 presents references cited in this document. Appendix A provides the piping and instrumentation diagrams (P&IDs) for the FTO system and vendor information. Appendix B includes a copy of Analytical Data Reports 1 through 7. Appendix C contains vendor quotes for various soil vapor treatment technologies.

2.0 DESCRIPTION OF TECHNOLOGY

FTO is a technology that can be used to treat extracted soil gas vapors that contain chlorinated and/or petroleum hydrocarbons. The extracted vapors are heated to temperatures sufficient to oxidize chemical constituents and form carbon dioxide and water vapor, and, in the case of chlorinated hydrocarbons, hydrochloric acid (HCl).

The following subsections describe the type of FTO system tested at Site FT-002, system treatment capabilities, and acceptance of the technology by regulatory agencies.

2.1 Description of Thermatrix Flameless Thermal Oxidation Unit

Thermatrix of Knoxville, Tennessee has developed a proprietary technology for FTO of VOCs in vapor streams. The Thermatrix GS Series FTO system employs a "packed-bed" ceramic matrix. The oxidation of volatile organic compounds (VOCs) in the influent vapor stream vapors occurs in a reaction zone contained within the ceramic matrix. Typical operating temperatures are between 1,600 to 1850 degrees Fahrenheit (° F). System exhaust gases are discharged directly to the atmosphere, or can be routed through a caustic scrubber to remove HCl if the influent vapors contain chlorinated VOCs.

The FTO system for the Plattsburgh AFB demonstration site was designed to extract and treat contaminated vapors at flow rates between 20 to 120 standard cubic feet per minute (scfm), and to reduce the influent VOC concentrations by not less than 99.99 percent. SVE vacuum is produced in the subsurface using multiple vapor extraction wells and an extraction blower. Extracted soil vapors are injected into the FTO unit at a regulated flow rate, pass through the static premixing chamber, and then into the reaction bed where complete oxidation occurs at approximately 1,800°F.

When the vapor stream reaches oxidation temperature, organic compounds react within the oxidizer vessel to form carbon dioxide, water, and (in the case of chlorinated hydrocarbons) HCl, releasing heat that is then reabsorbed by the ceramic matrix of the reaction bed. The system tested at Site FT-002 included an effluent caustic scrubber that is designed to remove at least 99.5 percent of HCl from the reactor exhaust at the maximum design loading rate of approximately 3.0 pounds per hour (lb/hr) of HCl. The GS Series FTO unit used at this site allows for a single pass of the extracted vapors through the oxidizer. A schematic of the FTO treatment process is presented in Figure 2.1. A complete process flow schematic of the FTO system is shown in the P&IDs presented as Figures A.1a and A.1b in Appendix A.

The FTO system is self-contained and skid-mounted on a trailer with a dedicated electrical distribution system. The system is designed to operate within single-circuit, 480-volt, 3-phase, 100-amp electrical power limitations. The system is enclosed to provide weather protection for system components that could be affected by temperature, moisture, and windblown particulates.

2.2 System Capabilities

Thermatrix manufactures a patented GS Series FTO treatment technology that incorporates a corrosion resistant ceramic matrix and oxidizer material that are immune to moisture and acid, noncatalytic, and have a temperature rating of up to 2,500°F. Thermatrix vendor information is provided in Appendix A.

Based on information provided by Thermatrix, a series of tests have demonstrated the inherent safety of the FTO system (Meltzer, 1992). Conditions considered to be worst-case from a safety standpoint were investigated by Thermatrix. Flow rates and concentrations of VOCs (as propane) were varied over wide ranges. The different flow rates through the unit resulted in residence times ranging from 0.15 second to 10 minutes, and the VOC concentrations 1000 to 160,000 parts per million, volume per volume (ppmv) spanned the flammability range from 5 percent of the lower explosive limit (LEL) to 170 percent of the upper explosive limit (UEL). Under all test conditions, no flashback or detonation occurred.

In many flame-based devices, some of the soil vapor can bypass the flame zone, which can result in the formation of products of incomplete combustion (PIC). The configuration of the flameless oxidizer is intended to eliminate these problems. The

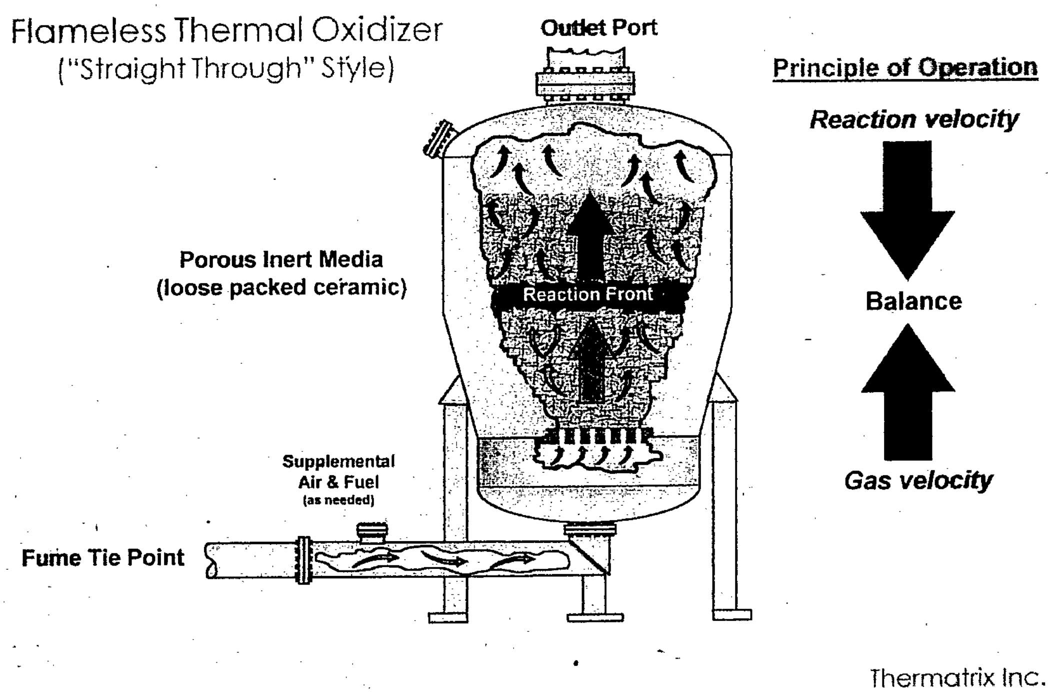

FIGURE 2.1

SCHEMATIC OF FTO TREATMENT PROCESS

FTO Demonstration
Fire Training Area FT-002
Plattsburg Air Force Base, New York

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

reaction zone covers the entire cross-section of the ceramic matrix, and all of the vapor must pass through the reaction zone before it exhausts from the oxidizer as carbon dioxide, water, and HCl.

Complete conversion of the VOCs to harmless byproducts and HCl occurs rapidly in the reaction zone of the FTO unit because of the intimate premixing of the influent contaminated vapors with air (oxygen) and the heat transfer properties of the ceramic matrix. Previous testing by Thermatrix has shown that a residence time of 0.15 second in the FTO can result in greater than 99.99 percent destructive removal efficiency (DRE) for hydrocarbon vapors. The flameless oxidizer tested at Plattsburgh AFB has a nominal residence time of 0.5 second (Thermatrix, 1992). There is no need for additional residence time.

According to Thermatrix, the FTO technology is capable of processing batch or variable-flow vapors or fumes because of the heat retention and radiant heat properties of the ceramic matrix design. It can handle VOC vapor spikes above nominal capacity, or a complete interruption in vapor flow, and remain functionally on-line with no upset condition or safety concerns (as could occur with a flame blow out). Turndown for batch or variable-flow fumes is generally limited by the span of the instruments or auxiliary equipment (e.g., blowers or flow control valves) used in the FTO system.

Although, influent vapors can vary in hydrocarbon concentration, a minimum of 12 percent oxygen within the influent vapor system is required to sustain the oxidation process. Because many hydrocarbon contaminated sites have low, initial soil gas oxygen levels, ambient air dilution is often required to ensure that 12 percent oxygen enters the oxidizer.

Previous performance tests by the manufacturer have demonstrated the 99.99-percent and greater DRE of the FTO system for a wide variety of VOCs, including chlorinated hydrocarbons (Meltzer, 1992; Thermatrix, 1992). Tests also have measured typical nitrogen oxide emissions of less than 2 ppmv and carbon monoxide emissions of less than 10 ppmv. Single-component and mixed organic vapor streams have been successfully treated, with vapor constituents that have included benzene, carbon tetrachloride, dichloromethane, ethyl chloride, isopropanol, methane, paint solvent mixtures, propane, and toluene. These compounds are chemically representative of many of the types of industrial VOCs, including chlorinated aliphatic hydrocarbons (CAHs). The test procedures, analytical methods, and performance results for the GS Series FTO unit are detailed in a separate vendor report (Thermatrix, 1992).

2.3 Capital Equipment

Table 2.1 provides the total capital cost for the Thermatrix GS Series FTO treatment system purchased by the Air Force for this demonstration. The FTO treatment system was purchased by the Air Force from Thermatrix on a "shared cost" basis. The Thermatrix contribution was $40,000, which is the difference between equipment funding requested by the Air Force and the established commercial value of the FTO system. Therefore, the cost paid by the Air Force for the FTO system was $235,265, versus an actual commercial cost of the FTO system was $275,265.

To determine the prorated capital cost for the 210-day Plattsburgh AFB demonstration, the total capital cost of $275,265 was averaged over an estimated 3 year life of the FTO system [($275,265/1,095 days) x 210 days = $52,790]. Because the quench/scrubber was not required to meet New York State Department of Environmental Conservation (NYSDEC) recommended annual air guideline concentrations (Section 2.4), the capital cost for the Plattsburgh demonstration also was calculated exclusive of the $62,000 cost for the quench/scrubber [($213,265/1,095

TABLE 2.1
SUMMARY OF VENDOR CAPITAL COSTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Item	Cost
Thermatrix Engineering and Project Management	$16,000
Basic FTO Treatment Unit	$164,000[a/]
Quench/Scrubber System	$62,000
FTO System Trailer	$19,500
SVE Blower and Knockout Drum	$3,615
Electrical Equipment	$4,900
Control Valves	$4,500
Miscellaneous Items	$750
TOTAL	$275,265

a/ This cost includes $40,000 contributed by Thermatrix for the design and fabrication of the FTO system.

days) x 210 days = $40,900]. Capital and operational costs to conduct the FTO system demonstration at the Plattsburgh AFB site are presented in Section 3.3.2.

2.4 Regulatory Acceptance

Acceptance of Thermatrix FTO systems by regulatory agencies has been widespread. Agencies that have approved this technology for site remediation include state environmental agencies, and local air quality districts. Based on information provided by Thermatrix, the following states have permitted Thermatrix FTO systems to date:

California	Georgia	Idaho
Indiana	Louisiana	Maryland
Massachusetts	Michigan	Mississippi
Montana	New Jersey	New York
North Carolina	Pennsylvania	South Carolina
Tennessee	Texas	

Also, Canada, England, and France have approved the use of this system. Additional projects are in progress in the Netherlands and Taiwan.

As part of the technology demonstration at Site FT-002, an application for a permit to construct/certificate to operate a process, exhaust, or ventilation system was submitted to the NYSDEC on April 22, 1996. As part of the application process, an air emissions regulation review was conducted (see Section 4.1) and mass VOC emission rates were calculated using Site FT-002 soil gas data collected in January 1996. Based on the regulatory review and the soil gas analytical results, off-gas control is required for full-scale soil vapor extraction at the FT-002 site. Three VOCs, benzene, trichloroethene (TCE), and pechloroethylene (PCE) were shown to be above NYSDEC annual guideline concentrations when no control was used. Despite HCl formation during FTO vapor treatment, the results indicted that a scrubber to remove

HCl is not necessary to meet NYSDEC annual guideline concentrations for air emissions [7 micrograms per cubic meter ($\mu g/m^3$)].

Recently, NYSDEC has adopted new air regulations that require owners and/or operators of air emission sources to obtain a Title V facility permits in accordance with NYSDEC regulations, Part 201 (NYSDEC, 1996). However, NYSDEC regulations Part 201-3 identifies exemptions to the Title V permit requirement. In accordance with NYSDEC regulations, operation of a soil vapor treatment system at Plattsburgh AFB may be exempt from Title V permitting requirements because it may be a "currently permitted emission unit" under NYSDEC regulations, Part 201-3.1(d), or may be considered a "trivial activity" under NYSDEC regulations, Parts 201-3.3 28, 29, or 30. Based on discussions with NYSDEC, facilities must have Title V air operation permits in place by June of 1997.

3.0 FIELD DEMONSTRATION RESULTS

Testing of the FTO system was conducted over a 30-week period from August 27, 1996 to March 25, 1997. The VE/VWs used during the testing period included monitoring well MW-108, and VE/VW-2 through -14 (See Figure 3.1). Individual wells and/or pairs of wells were tested for a period of up to two weeks per well (or well pair) to determine the optimum vacuum/extraction flow rate balance among all wells and soil vapor VOC concentrations for each well.

The FTO system configuration for the field demonstration is presented in Section 3.1. Test data collected for design and operation of a full-scale system included soil vapor concentrations and vapor extraction rates (Section 3.2). The performance of the FTO system during the demonstration at Site FT-002 is described in Section 3.3.

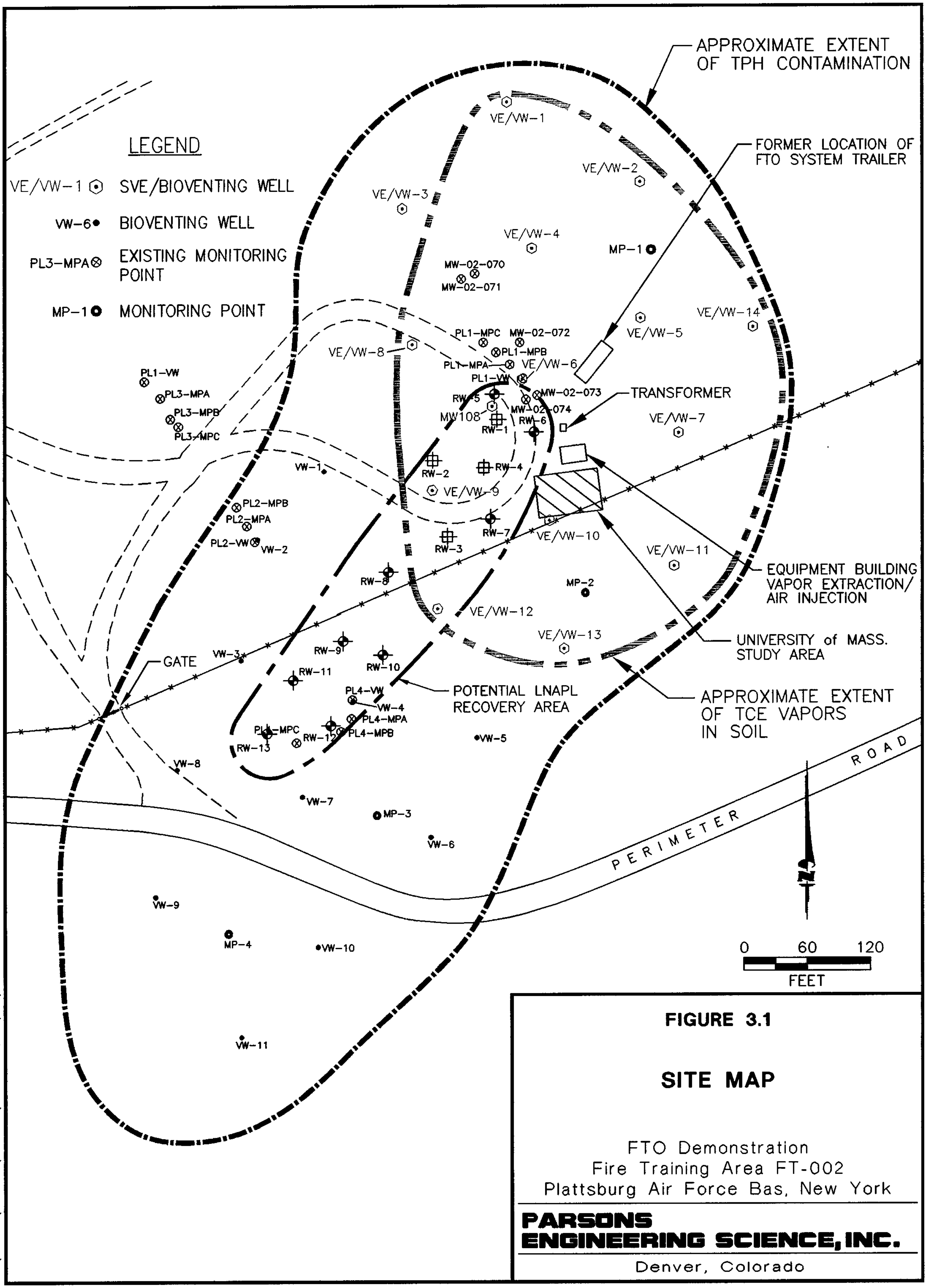

FIGURE 3.1

SITE MAP

FTO Demonstration
Fire Training Area FT-002
Plattsburg Air Force Bas, New York

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Denver, Colorado

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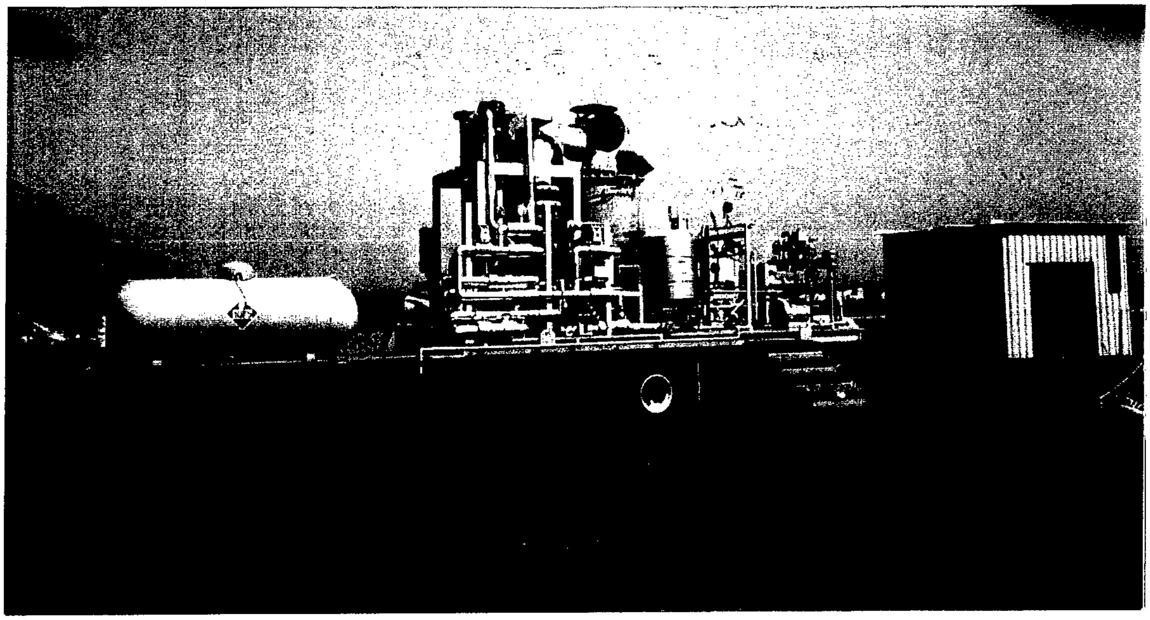
3.1 FTO System Configuration

The trailer-mounted FTO pilot test unit was positioned near the location of VE/VW-6 (Figure 3.1). Power (480-volt/3-phase) was supplied to the FTO using an existing onsite power supply. Propane was required as a supplemental fuel supply to maintain reactor bed operating temperatures, and was supplied by a local vendor to the 500 gallon propane tank mounted on the FTO system trailer. Initially, the FTO system was connected to the SVE wells using abovegrade, temporary flexible, 2-inch-diameter, PVC-suction hose. The piping manifold for the full-scale SVE system was used to connect the FTO system to the vapor wells after it was completed by OHM during the week of December 23, 1996. Soil vapor was extracted from vent wells using a 6-horsepower vacuum blower. P&IDs of the FTO unit are included in Appendix A. Figure 3.2 provides photographs of the FTO system layout.

The FTO unit was designed to extract and treat contaminated vapors at flow rates between 20 to 120 scfm and to reduce the influent VOC concentrations by not less than 99.99 percent. The system also includes an effluent caustic scrubber to remove HCl, which can form during the breakdown of chlorinated solvents. However, the scrubber was not used during operation at Site FT-002 because estimated mass emission rates of HCl for the FTO demonstration were less than NYSDEC annual guideline concentration for air emissions (7 $\mu g/m^3$).

During field testing, the influent vapor flow rate to the FTO unit was maintained at 100 scfm by using a combination of soil vapors and ambient air. It was necessary to bleed in ambient air to maintain oxygen concentrations in the FTO vapor influent of greater than 12 percent.



Photograph 1. FTO Treatment System and Trailer at Platsburgh AFB.

Photograph 2. FTO Treatment System at Plattsburg AFB.

FIGURE 3.2

PHOTOGRAPHS OF FTO SYSTEM LAYOUT

FTO Demonstration
Fire Training Area FT-002
Plattsburg Air Force Base, New York

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Denver, Colorado

3.2 Soil Vapor Concentrations and Extraction Rates

The primary chemicals of concern at Site FT-002 are benzene, TCE and PCE. Influent and effluent vapor sample analytical results are summarized in Table 3.1. Field measurements taken during the technology demonstration are summarized in the Analytical Data Reports presented in Appendix B. The most recent summary of field measurements is presented in Analytical Data Report 7. Data collected during FTO unit testing included laboratory analysis of influent and effluent vapor samples using USEPA Method TO-14, soil vapor extraction rates, and field measurements using hand held instruments for oxygen, carbon dioxide, and total hydrocarbons.

The concentrations of THC detected by the laboratory, using Method TO-14, in the influent vapor stream ranged from 12 to 6,000 ppmv, with the highest concentrations recovered from VE/VW-6 (Table 3.1). During the field demonstration a total of 8,162 pounds of THC vapors were recovered from the soil over a total of 139 days of extraction. The highest concentration of benzene was recovered from VE/VW-6 at 16 ppmv. The highest concentration of TCE and PCE were recovered from VE/VW-14 at concentrations of 120 and 71 ppmv, respectively. Soil vapor oxygen concentrations varied at each vent well, and initial concentrations ranged from 0 to 19 percent (Table 3.1). In general, soil vapor oxygen concentrations increased as the number of days of operation increased because initial soil gas was replaced by oxygen rich soil gas. For example, in October 1996, the concentration of oxygen in soil gas extracted from VE/VW-6 increased from 0 to 9 percent over 10 days of FTO operation.

The SVE flow rates for individual extraction wells ranged from 40 to 90 scfm, with the greatest rate of air flow rate occurring at VE/VW-6 (Table 3.1). The influent vapor flow rate to the FTO unit was held constant at 100 scfm by using an automatically controlled air bleed-in valve. This valve regulated the amount of ambient

TABLE 3.1
SUMMARY OF SOIL VAPOR CONCENTRATIONS AND VAPOR EXTRACTION RATES
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Extraction	Predilution Influent Concentrations (ppmv)[a/] THC[b/]	Benzene	TCE[c/]	PCE[d/]	Well Vapor Flow Rate (scfm)[e/]	Influent Oxygen (percent)	Pounds of Chemical Recovered THC	Benzene	TCE	PCE
9/2/96	VEW/MW-108	7.00	5,800	5.1	57	-[f/]	67.6	18.9	1,023	0.90	10.05	-
9/25/96	VEW/VW-5	16.40	3,600	0.9	49.0	5.4	43.5	10.0	957	0.23	13.03	1.44
10/14/96	VEW/VW-6	0.02	3,300	12.0	1.8	<0.9	19.1	0.0	0.47	0.00	0.00	0.00
10/24/96	VEW/VW-6	19.60	6,000	16.0	29.0	<1.3	56.5	9.0	2,476	6.60	11.97	0.00
12/6/96	VEW/VW-7	0.10	23	ND[g/]	16.0	2.8	46.2	18.0	0.04	0.00	0.03	0.00
12/9/96	VEW/VW-7	3.00	68	ND	35.0	2.9	76.9	15.9	6	0.00	3.01	0.25
12/9/96	VEW/VW-14	0.10	120	ND	120.0	0.37	81.3	11.0	0.36	0.00	0.36	0.00
12/13/96	VEW/VW-14	3.90	200	ND	0.4	71.0	64.3	16.0	19	0.00	0.04	6.64
12/18/96	VEW/VW-8	3.90	690	0.2	0.2	ND	44.8	13.5	45	0.01	0.01	0.00
12/24/96	VEW/VW-8	3.00	690	0.4	0.4	ND	53.6	-	41	0.03	0.02	0.00
12/27/96	VEW/VW-8	3.10	530	0.3	0.2	ND	60.0	-	37	0.02	0.01	0.00
12/27/96	VEW/VW-9	0.02	20	-	-	-	70.4	-	0.01	0.00	0.00	0.00
1/3/97	VEW/VW-9	6.84	18	0.015	0.3	0.0	75.0	21.0	3	0.00	0.06	0.00
1/3/97	VEW/VW-12	0.17	180	0.3	26.0	ND	69.2	15.8	1	0.00	0.11	0.00
1/7/97	VEW/VW-12	3.71	580	1.2	33.0	ND	69.2	-	55	0.11	3.16	0.00
1/7/97	VEW/VW-13	0.04	490	0.8	24.0	0.5	47.5	9.0	0.35	0.00	0.02	0.00
1/14/97	VEW/VW-13	6.71	180	0.3	6.5	0.3	45.2	18.8	20	0.03	0.73	0.03
1/14/97	VEW/VW-10	3.40	550	0.6	21.0	2.2	71.0	13.0	49	0.05	1.89	0.20
1/22/97	VEW/VW-3	4.41	1,200	0.2	ND	ND	40.9	3.3	81	0.02	0.00	0.00
1/27/97	VEW/VW-4	0.09	ND	0.0	0.0	ND	49.1	6.8	0.00	0.00	0.00	0.00
2/3/97	VEW/VW-4	6.66	870	0.3	0.1	ND	47.9	7.7	103	0.04	0.01	0.00
2/3/97	VEW/VW-2	0.08	12	ND	1.4	0.0	82.4	17.5	0.03	0.00	0.00	0.00
2/4/97	VEW/VW-2	0.91	13	ND	1.2	0.0	80.4	18.0	0.35	0.00	0.03	0.00
2/4/97	VEW/VW-11	0.04	25	ND	13.0	1.7	75.0	19.7	0.03	0.00	0.01	0.00
2/7/97	VEW/VW-11	1.85	24	ND	7.1	0.8	75.0	20.2	1	0.00	0.37	0.04
2/7/97	VEW/VW-6 and -14	0.05	1,500	3.2	35.0	ND	63.3	6.7	2	0.00	0.04	0.00
2/19/97	VEW/VW-6 and -14	11.83	3,700	10.0	18.0	ND	75.4	9.9	1,230	3.32	5.98	0.00
2/21/97	VEW/VW-6 and -14	2.55	3,800	8.1	28.0	ND	63.5	11.0	229	0.49	1.69	0.00
2/24/97	VEW/VW-6 and -14	2.86	4,200	9.1	19.0	ND	63.9	11.1	286	0.62	1.29	0.00
3/5/97	VEW/VW-6 and -14	9.34	2,500 [h/]	6	20	ND	60.0	12.0	522	1.29	4.18	0.00
3/6/97	VEW/VW-6 and -14	0.84	2,549 [h/]	8	24	ND	66.7	11.8	53	0.16	0.50	0.00
3/11/97	VEW/VW-6	5.10	3,448 [h/]	7	22	ND	66.7	14.0	437	0.95	2.85	0.00
3/18/97	VEW/VW-6	4.69	2,899 [h/]	8	25	ND	89.7	15.2	454	1.24	3.85	0.00
3/19/97	VEW/VW-14	0.98	272 [h/]	ND	50	0.35	62.5	15.9	6	0.00	1.13	0.01
3/20/97	VEW/VW-14	1.02	111 [h/]	ND	32	0.32	74.6	13.8	3	0.00	0.91	0.01
3/25/97	VEW/VW-14	4.85	125 [h/]	ND	24	0.41	78.7	16.7	18	0.00	3.43	0.06
	Total =	139				Average =	63	Total =	8,162	16	71	9

[a/] ppmv = parts per million by volume, as determined by the analytical laboratory.
[b/] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).
[c/] TCE = Trichloroethene.
[d/] PCE = Perchloroethene.
[e/] scfm = standard cubic feet per minute.
[f/] -=Not available.
[g/] ND = not detected.
[h/] = Predilution soil vapor concentrations for THC, benzene, TCE and PCE were estimated using the analytical results of post dilution vapor samples.

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air that was added to the extraction well vapor stream to maintain a constant flow rate into the FTO unit.

3.3 Observed FTO Performance

The performance of the Thermatrix FTO system was evaluated based on three primary criteria: treatment efficiency, cost, and reliability and maintainability. Performance evaluation results are presented in the following subsections.

3.3.1 Vapor Treatment Efficiency

FTO vapor treatment efficiencies for THC, benzene, TCE, and PCE are presented in Table 3.2, and were calculated using the following equation:

$$\frac{\text{Concentration}_{\text{Influent}} - \text{Concentration}_{\text{Effluent}}}{\text{Concentration}_{\text{Influent}}} \text{ X } 100$$

The vapor treatment efficiency of the Thermatrix FTO system was evaluated using analytical results for samples collected during the March 1997 testing period. The March 1997 vapor samples most accurately reflect the treatment efficiencies of the FTO system because the sampling procedures were revised at this time to collect inlet vapor samples following the addition of dilution air. The revised sampling procedures are presented in Attachment 1 of Analytical Data Report No. 6 provided in Appendix B. The influent/effluent data collected through February 1997 cannot be used to accurately determine the treatment efficiency of the FTO system.

The influent and effluent vapor streams of the FTO unit were sampled using 1-liter SUMMA® canisters, and samples were analyzed by Air Toxics, Ltd. of Folsom California for VOCs using USEPA Method TO-14. Based on March 1997 data, the FTO unit was 99.96 percent efficient at removing THC, and between 99.98 and 100 percent efficient at removing benzene, TCE, and PCE from extracted soil vapors

TABLE 3.2
SUMMARY OF FTO TREATMENT EFFICIENCIES
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Pre-Dilution Oxygen (percent)	Post-Dilution Oxygen (percent)	FTO Influent Vapor Concentrations (ppmv)[a]				Well Air Flow Rate (scfm)[e]	FTO Inlet Air Flow Rate (scfm)	FTO Effluent Vapor Concentrations (ppmv)			
					THC[b]	Benzene	TCE[c]	PCE[d]			THC	Benzene	TCE	PCE
3/5/97	VEW/VW-6 and -14	9.34	12.0	17.1	1,500	3.7	12.0	ND[f]	60.0	100	ND	ND	ND	ND
3/6/97	VEW/VW-6 and -14	0.75	11.8	15.8	1,700	5.2	16.0	ND	66.7	100	0.860	0.005	0.019	ND
3/11/97	VEW/VW-6	0.10	14.0	16.8	2,300	5.0	15.0	ND	66.7	100	1.400	ND	0.004	ND
3/18/97	VEW/VW-6	3.69	15.2	16.0	2,600	7.1	22.0	ND	89.7	100	ND	ND	ND	ND
3/19/97	VEW/VW-14	0.98	15.9	18.0	170	ND	31.0	0.2	62.5	100	0.240	0.009	ND	ND
3/20/97	VEW/VW-14	1.02	13.8	16.9	83	ND	24.0	0.2	74.6	100	ND	ND	ND	ND
3/25/97	VEW/VW-14	4.85	16.7	18.3	98	ND	19.0	0.3	78.7	100	ND	ND	ND	ND

Date Sampled	Extraction Well		FTO System Treatment Efficiency (percent removal)			
			THC	Benzene	TCE	PCE
3/5/97	VEW/VW-6 and -14		100	100	100	NA[g]
3/6/97	VEW/VW-6 and -14		99.95	99.90	99.88	NA
3/11/97	VEW/VW-6		99.94	100	99.97	NA
3/18/97	VEW/VW-6		100	100	100	NA
3/19/97	VEW/VW-14		99.86	NA	100	100
3/20/97	VEW/VW-14		100	NA	100	100
3/25/97	VEW/VW-14		100	NA	100	100
		Average =	**99.96**	**99.98**	**99.98**	**100.00**

[a] ppmv = parts per million by volume, as determined by the analytical laboratory.
[b] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).
[c] TCE = Trichloroethylene.
[d] PCE = Perchloroethylene.
[e] scfm=
[f] ND = not detected.
[g] NA = Not applicable, compound not detected in influent vapor stream.

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(Table 3.2). Complete summaries of organic constituents identified during laboratory soil vapor analyses are summarized in data tables within each of the Analytical Data Reports presented in Appendix B.

3.3.2 Operating Costs

The costs for the FTO system demonstration are summarized in Table 3.3. The total cost for FTO system monitoring and operation for a total of 210 days during the period from August 27, 1996 to March 25, 1997, was $73,934 (exclusive of quench/scrubber costs). During the field demonstration a total of 8,162 pounds of THC vapors were recovered from the soil over a total of 139 days of vapor extraction. The treatment cost of $73,934 is equivalent to $9.05 per pound of THC recovered ($4.1 per kilogram). Excluded from these costs are Parsons ES labor costs and the cost of vapor and air emission sampling, which would be relatively consistent for other treatment technologies. Approximately 5 labor hours per week was required for system sampling and maintenance, including removal of liquid condensate collected in the knock-out tank. During the testing, approximately 60 gallons of condensate was removed and disposed of at the Site FT-002 groundwater treatment plant.

Approximately 9,000 kilowatts of electricity was used during system operation. At an estimated cost of $0.10 per kilowatt hour, the total electricity cost was approximately $900. A total of 9,433 gallons of propane was consumed during the demonstration. At an average cost of $1.15 per gallon, including delivery, the total cost of propane was $10,777. Costs to mobilize/demobilize the FTO equipment, including transportation of the unit to and from site, was $21,357.

TABLE 3.3
SUMMARY OF FTO TECHNOLOGY DEMONSTRATION COSTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Cost Item	Subtotal with Quench/Scrubber	Subtotal without Quench/Scrubber
Capital Costs	$52,790[a]	$40,900[b]
Thermatrix Mobilization/Startup	$12,360	$12,360
Transportation of Treatment Unit to and from Site	$6,246	$6,246
Electricity[c]	$900	$900
Propane[d] (112 days of operation)	$10,777	$10,777
Thermatrix Demobilization	$2,751	$2,751
TOTAL	$85,824	$73,934

a/ Daily capital cost is the total vendor capital costs (including the quench/scrubber) averaged over an estimated 3 year life of the FTO system [($275,265/1,095 days) x 210 days = 52,790].

b/ Daily capital cost is the total vendor capital costs not including the quench/scrubber averaged over an estimated 3 year life of the FTO system [$213,265/1,095 days) x 210 days = $40,900].

c/ Excludes power costs for site SVE blower and assumes $0.10 per kilowatt hour.

d/ Costs based on actual propane use and average cost of $1.15 per gallon.

3.3.3 Reliability and Maintainability

Once minor mechanical and operational problems were resolved and air flow conditions from the VE/VWs were balanced, the system proved to be reliable. The FTO system operated for 156.5 days over a 210-day period, which is equivalent to a 75-percent run time. The majority of the down time was due to heavy rains causing damage to the variable frequency drive (VFD) controller. This occurred on two separate occasions: on September 9 and on November 4, 1996. Parsons ES and Thermatrix worked together to redesign the VFD to better protect it from the weather. The redesigned VFD was installed on December 4 and 5, 1996, and the system was restarted. The FTO treatment unit was operational 96 percent of the time from December 6, 1996 to March 25, 1997, including 100 percent of the time during the month of February 1997. On December 21, 1996, an auto dialer alarm system was installed on the FTO system to enable Parsons ES to be promptly notified when a system shutdown occurred.

In January 1997, the FTO system shut down twice due to a low supplemental fuel pressure propane reading that was caused by very cold ambient temperatures (minus 27°F). At very low ambient temperatures (subzero), the vapor pressure from the propane tank is reduced, resulting in low supplemental fuel vapor pressure shut down of the FTO treatment unit. The pressure regulator for supplemental fuel located at the propane tank was increased, which alleviated the problem of shut down associated with low-vapor-pressure readings due to extreme cold temperatures.

A special consideration for operation of the FTO unit is the influent vapor oxygen concentration. During the week of October 14, 1996, Thermatrix conducted performance tests to determine the lowest influent oxygen concentration at which the unit can operate. During the tests, it was determined that the FTO unit could operate effectively at an influent oxygen concentration of 12 percent. The influent oxygen concentrations prior to dilution (direct from the vent wells) typically ranged from 9 to 19 percent. Post-dilution influent oxygen concentrations were typically above 12 percent. The oxygen content is critical to ensure complete stoichiometric combustion of all chemical constituents present in the vapor stream.

Regular monthly maintenance for the Thermatrix FTO system is minimal. Because the unit is relatively simple to operate, Base personnel (technicians) can be trained to perform regular maintenance. Regular maintenance which will require 1 to 3 hours per week, would typically include checking the supplemental fuel and supply emptying the condensate tank. If a scrubber were required, regular maintenance may require an additional 8 hours per week of technical oversight. If fuel is supplied from a storage tank then fuel levels must be monitored, and new supply ordered, to ensure uninterrupted system operation. The condensate knock-out tank must be monitored and emptied on a regular basis. During FTO testing the 30 gallon knock-out tank was emptied twice, and the condensate was disposed of through the Site FT-002 groundwater treatment system.

3.4 Technology Performance Summary

The treatment efficiency results indicate that the FTO unit was 99.96 percent efficient at removing THC and between 99.98 and 100 percent efficient at removing benzene, TCE, and PCE from extracted soil vapors. The treatment efficiencies represent the percent reduction in concentrations between constituents detected by the laboratory in the FTO system influent and effluent vapor streams.

The total cost for FTO system monitoring and operation for a total of 210 days over a 30-week period from August 27, 1996 to March 25, 1997, was $73,934 (Table 3.3). Based on 8,162 pounds of THC removed (Table 3.1), the treatment cost is equivalent to $9.05 per pound. During this pilot study, influent THC concentrations ranged from 12 to 6,000 ppmv from the wells.

Once periodic and initial mechanical problems were corrected and air flow conditions were balanced, the system proved to be reliable and was operational 96 percent of the time between December 6, 1996 and March 25, 1997. The Thermatrix FTO system is designed to operate unmanned; however, approximately 12 hours per month should be anticipated for maintenance and monitoring activities. System checks, influent/effluent sampling, disposal of condensate, and supplemental fuel monitoring will require approximately 3 hours of technician labor each week.

Recommendations for improvements to the FTO unit would include an automated control for monitoring and maintaining influent oxygen concentrations at a minimum of 12 percent oxygen using ambient air. The automated oxygen control should be tied into the ambient air bleed-in value.

Based on vendor information and the Site FT-002 demonstration at Plattsburgh AFB, the Thermatrix FTO technology is an effective method of treating a mixed vapor stream containing aromatic and CAHs in extracted soil vapors at this site.

4.0 FULL SCALE VAPOR RECOVERY AND TREATMENT FOR SITE FT-002

This section evaluates full-scale design considerations for SVE and alternatives for soil vapor treatment at Site FT-002 at Plattsburgh AFB.

4.1 Full-Scale Design Considerations

Test data necessary for full-scale design of an SVE and treatment system include vapor extraction rates, soil vapor VOC and oxygen concentrations, and NYSDEC air emission permitting requirements. These data are presented in Tables 3.1 and 3.2. Air permitting requirements are reviewed in Section 2.2.1

The Action Memorandum (Parson ES, 1996b) for Site FT-002 stated that SVE would be required for all vadose zone wells at which soil gas was found to contain TCE, and that bioventing would be initiated at wells that do not contain TCE. During the FTO demonstration, testing was conducted using SVE wells (MW-108 and VE/VW-2 through -14). Vapor well VE/VW-3 did not have measurable concentrations of TCE, and VW-4 had TCE concentrations of less than 0.1 ppmv (Table 3.1). The areal extent of the TCE-impacted area is outlined on Figure 3.1.

Parsons ES (1997a) submitted an emission control evaluation for the operation of the SVE system at Fire Training Area FT-002 to OHM. An amendment to the evaluation was submitted to OHM in March, 1997 (Parsons ES, 1997b). The evaluation considered various SVE system operating scenarios and conducted computer simulations using Air Guide-1 (NYSDEC, 1991) dispersion formulas published by NYSDEC. The results of the emission control evaluation indicate the most appropriate vapor control and treatment scenario for TCE contaminated vapors would include: extracting and treating soil vapors from VE/VW-5, -6, -7, -10, -11, -12, -13, and -14, and extracting and discharging to the atmosphere soil vapors recovered from VE/VW-1, -2, -3, -4, -8, and -9. Soil vapors would be extracted from each well at a rate of 75 scfm and emission control equipment would be required to meet a DRE of 87 % for the treated air stream to be in compliance with NYSDEC air emission guidelines. This scenario would require emission control equipment capable of treating a minimum of 500 to 600 scfm of soil vapor.

Typically during operation of an SVE system, vapor recovery may at some point become diffusion limited. A diffusion-limited state occurs when the rate of chemical mass recovery becomes a function of the rate at which chemicals desorb or volatilize from solid or liquid phase into a vapor phase. When the system has reached a diffusion-limited state, high extraction rates do not produce higher contaminant removal rates and pulsed vapor extraction or cycling between wells may be the most efficient method of operation for removal of chemical mass.

Using results from a bioventing pilot test (Parson ES, 1992), a fuel hydrocarbon biodegradation rate at the site of 400 kg of TPH per day is estimated. Assuming an average decrease of 15 percent in soil gas oxygen concentrations from the outer site perimeter to a vent well, an average soil vapor extraction rate of 264 scfm across the area of hydrocarbon contamination would be sufficient to provide the oxygen required to support hydrocarbon biodegradation processes. An optimum vapor extraction rate for bioventing at the site is expected to fall between 260 and 300 scfm. Actual vapor recovery rates should be optimized during full-scale startup and will be a function of vapor recovery rates, chemical mass recovery , and oxygen concentrations in soil.

4.2 Cost Comparison of Vapor Treatment Technologies

A cost comparison was developed for four soil vapor treatment technologies, including FTO, resin bed adsorption, catalytic oxidation, and activated carbon. The purpose of the cost comparison was to develop an approximate range of expected costs necessary to treat soil vapors at Site FT-022 over a 3-year period. Full-scale design considerations identified in Section 4.1 include operation of a soil vapor treatment system at a vapor flow rate of between 500 and 600 scfm with a required DRE for TCE of 87 percent.

Soil vapor treatment system vendors were requested to provide a cost proposal for a soil vapor treatment system assuming: soil vapor flow rate of 500 scfm, average influent THC concentration of 1,100 ppmv, average influent TCE concentration of 21 ppmv, and a required DRE of 87 percent for TCE. Based on a 500-scfm flow rate, the expected chemical mass recoveries are 191 pounds per day (87 kilograms per day) of THC and 3.9 pounds per day (1.77 kilograms per day) of TCE. Vapor concentrations observed for specific chemical constituents detected at the site are listed in Table 3.1 and in Appendix B. The vendor estimates for soil vapor treatment systems are presented in Appendix C.

The results of the comparative cost evaluation are summarized in Table 4.1 and presented graphically in Figure 4.1. The results of the cumulative cost comparison show that over a 3-year period of operation, capital and operation and maintenance costs for thermal, catalytic, or resin bed soil vapor treatment systems range from $264,000 to $310,000. Activated carbon treatment (cumulative cost of $3.6 million) was not considered a cost effective treatment technology for this site. The soil vapor treatment vendors have indicated that their respective treatment technologies are capable of achieving a minimum required DRE of 87 percent for TCE. The costs of treating THC using the thermal, catalytic, or resin bed treatment technology range from approximately $1.86 to $3.45 per pound ($0.85 to $1.56 per kilogram), over a one year period, and approximately $1.27 to $1.48 per pound ($0.57 to $0.67 per kilogram) over a 3-year period of operation.

The most appropriate treatment technology will be a function of the duration that the system will be operating onsite and the expected change in soil vapor concentrations over that time period. More detailed vendor cost estimates would be required prior to selecting the most appropriate treatment technology. Consideration also would need to be given to other factors such as vendor product warranties, durability of system components, component replacement costs and frequency of replacement, and overall vendor reliability.

TABLE 4.1

COST COMPARISON OF FULL-SCALE VAPOR TREATMENT TECHNOLOGIES

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Vapor Treatment Technology	Capital Costs	Shipping Installation and Setup	Annual Costs (365 days)			Expected DRE	Cummulative Annual Costs over Cost Per Pound of THC Treated [a/]			Comments
			Labor	Electricity	Fuel [b/]	%	1 year	2 year	3 year	
Thermatrix FTO	$200,000	$12,000	$5,000	$1,500	$21,900	99.99	$240,400 $3.45	$268,800 $1.93	$297,200 $1.42	Thermatrix estimate See Appendix C Does not include blower.
Thermatrix Resin Bed	$200,000	$12,000	$10,000	$13,140	$0	95	$235,140 $3.37	$258,280 $1.85	$281,420 $1.35	Thermatrix estimate See Appendix C Does not include blower.
E Products Thermal Oxidation	$43,111	$12,000	$5,000	$3,000	$76,957	99	$140,068 $2.01	$225,024 $1.61	$309,981 $1.48	E Products estimate See Appendix C Does not include blower.
Therm Tech Thermal Oxidation	$50,500	$12,000	$5,000	$3,000	$59,367	95	$129,867 $1.86	$197,233 $1.41	$264,600 $1.27	ThermTech estimate See Appendix C Does not include blower or PLC.
Therm Tech Catalytic Oxidation	$75,800	$12,000	$10,000	$3,000	$49,472	90	$150,272 $2.16	$212,744 $1.53	$275,216 $1.32	ThermTech estimate See Appendix C Does not include blower or PLC.
Carbon	$50,000	$12,000	$10,000	$1,500	$1,161,917		$1,235,417 $17.72	$2,408,833 $17.28	$3,582,250 $17.13	Parsons ES estimate assuming 191 lb/day mass load, 15 % carbon load rate per day, $2.50/lb carbon regeneration, 2 x 20K lb vessels

Notes:

= Estimated cost.

a/ The cost per pound of THC treated equals the cummulative costs divided by the cummulative number of days of operation, assuming mass recovery of THC at 191 lb/day, and vapor flow rate of 500 scfm.

b/ Actual propane fuel costs at Plattsburgh AFB are $1.15/gallon or $12.55/MM BTU assuming 91,600 BTU per gallon.

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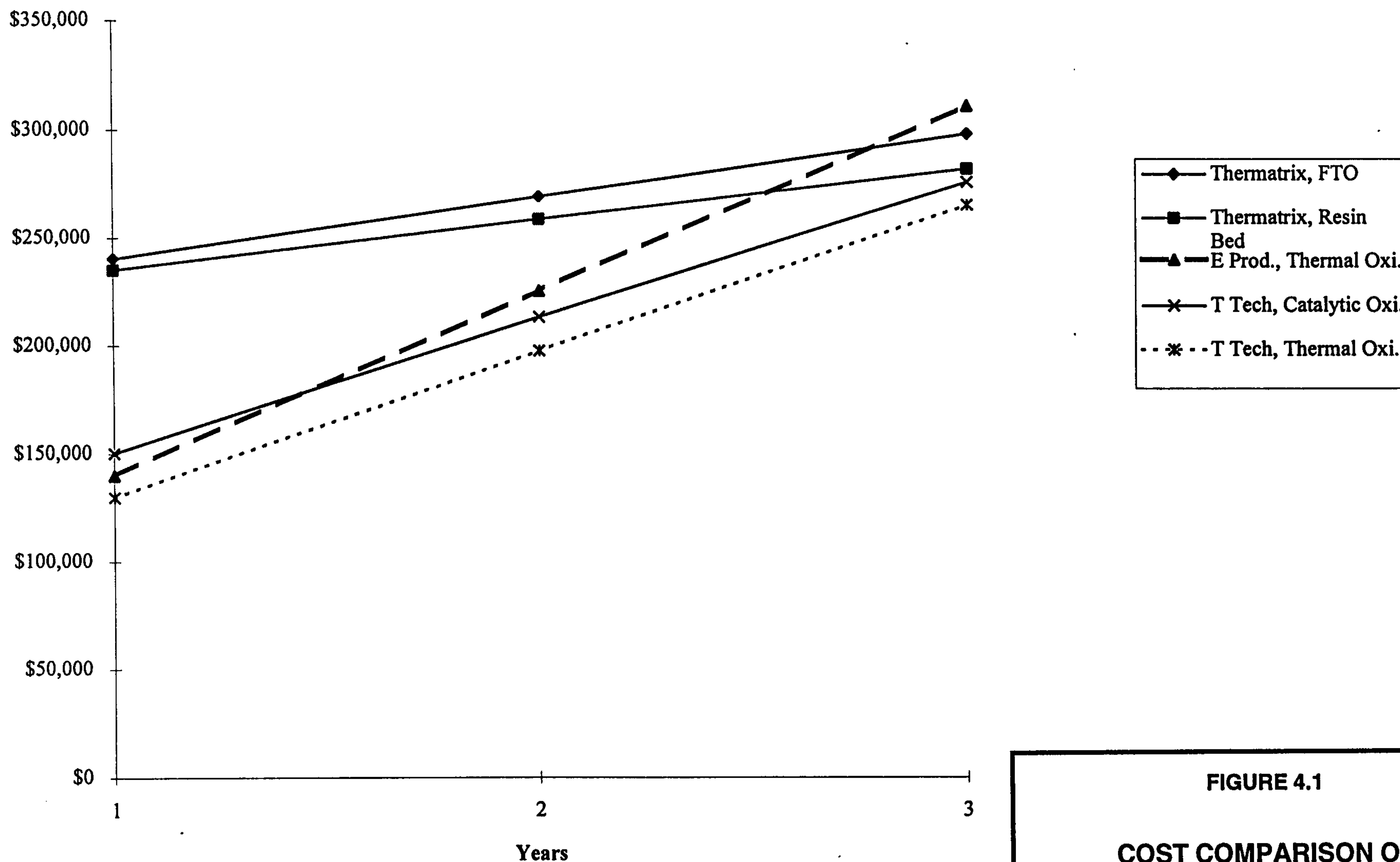

FIGURE 4.1

COST COMPARISON OF VAPOR TREATMENT TECHNOLOGIES

FTO Demonstration
Fire Training Area FT-002
Plattsburgh Air Force Base, New York

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

5.0 REFERENCES

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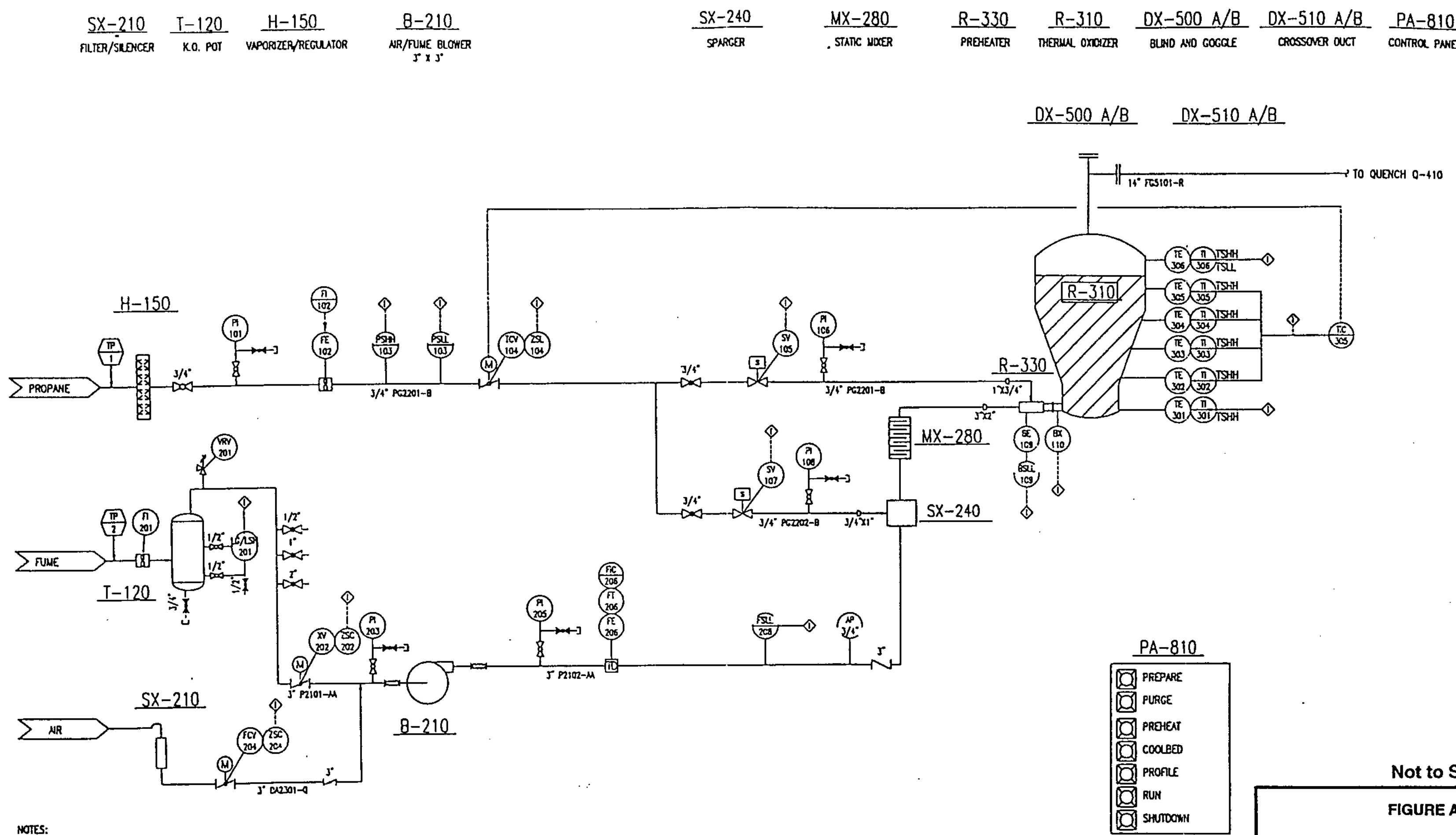
APPENDIX A

PIPING AND INSTRUMENTATION DIAGRAMS AND VENDOR INFORMATION



NOTES:

1. AREA CLASSIFICATION IS GENERAL SERVICE
2. INSTRUMENT AIR IS NOT AVAILABLE
3. ALARM INDICATIONS ARE PROVIDED FOR ALL SWITCHES
4. ESD KILLS ALL SKID OPERATIONS

Not to Scale

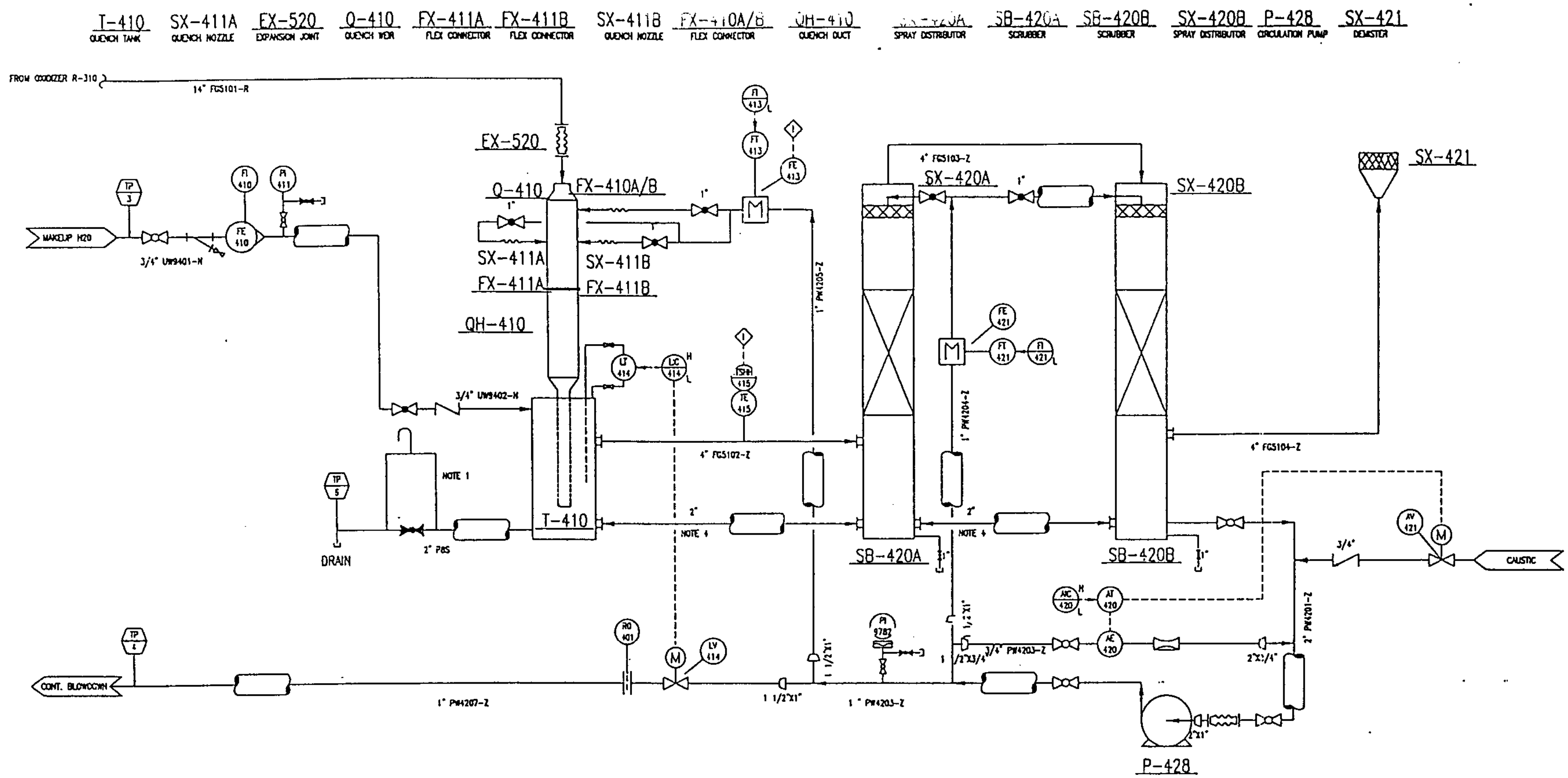
FIGURE A.1a

FRONT (INFLUENT) HALF OF FTO PIPING AND INSTRUMENTATION DIAGRAM

FTO Demonstration
Fire Training Area, FT-002
Plattsburgh AFB, New York

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Sources: Thermatrix, Inc. 1995.



Not to Scale

NOTES:

1. SEAL LEG OVERFLOWS AT HIGH LEVEL
2. INSTRUMENT AIR IS NOT AVAILABLE
3. STATUS OF ALL SWITCHES IS INDICATED
4. COMMON SUMP TIE LINE

FIGURE A.1b

BACK (EFFLUENT) HALF OF FTO PIPING AND INSTRUMENTATION DIAGRAM

FTO Demonstration
Fire Training Area, FT-002
Plattsburgh AFB, New York

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Sources: Thermatrix, Inc. 1995.

Halogenated VOC Abatement

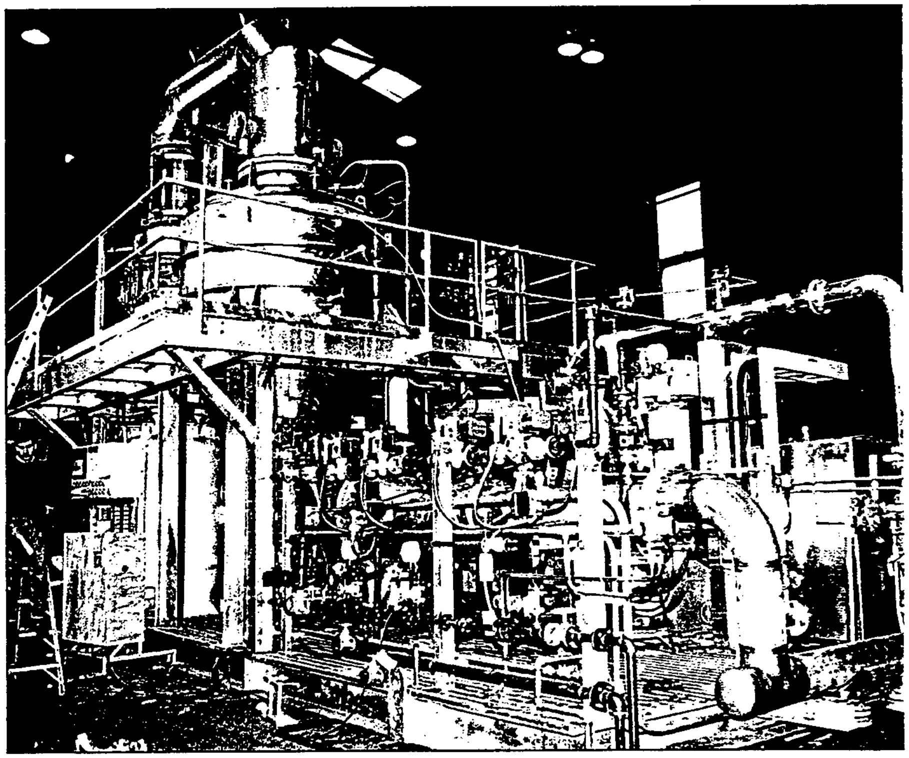
FLAMELESS THERMAL OXIDATION

INTRODUCTION

A major chemical company has installed (1995) and is operating a Thermatrix flameless thermal oxidation system for treatment of methylene chloride emissions from herbicide production. Prior to this installation, traditional flame-based technology was the corporate standard for this application.

PROCESS DESCRIPTION

The herbicide manufacturing process consists of various unit operations that continuously or intermittently vent process gases containing chlorinated VOCs. The combined vent stream includes 275 pounds per hour methylene chloride, six pounds per hour CO, and traces of methanol, formaldehyde and dichloromethyl ether. Venting results from equipment de-pressurization, controlled process venting, equipment purges, batch chemical transfers and normal breathing losses. Vents are collected and routed to the Thermatrix system for treatment.



FLAMELESS THERMAL OXIDIZER SYSTEM FOR HERBICIDE PLANT CVOCS
FULLY AUTOMATED, HIGH ALLOY REACTOR WITH QUENCH
1500 SCFM TOTAL FLOW

THERMATRIX SYSTEM DESCRIPTION

The skid-mounted, fully automated abatement system consists of a Thermatrix reactor and an effluent gas quench which feeds directly to a pre-existing scrubber system. The system is designed for a total flow of 1500 scfm. Prior to shipping, the system was preassembled and modularized to the extent possible to minimize on-site installation work scope.

The system is fed by two vent collection headers which are combined immediately prior to entering the main fume line. Both streams are water saturated, with one containing high concentrations of VOCs inerted with nitrogen to reduce flammability. The second stream contains relatively low concentrations of VOCs and is continuously purged with air.

During operation, combustion air is added to the combined vent streams in the main fume line to maintain a minimum oxygen concentration. The premixed fume is then introduced to the Thermatrix reactor, where the organics are oxidized to carbon dioxide and water vapor. An acid gas (HCl) is produced and quenched, then sent directly to a pre-existing caustic scrubber for neutralization. All materials of construction are appropriate for the processing of corrosive gases.

INSTALLATION, COMMISSIONING & PERFORMANCE TESTING

On-site installation was completed in less than 6 days. Performance testing and analysis were performed by a laboratory using EPA test protocol methods 18 and 25. Inlet samples containing up to 300 ppm of total hydrocarbons were taken from the main fume line. Outlet samples collected at the stack revealed undetectable hydrocarbons at a 1 ppm detection limit.

A TOTAL SOLUTION

This Thermatrix application has been field proven to be safe, economical and effective. Direct comparison with alternative technologies reveals similar capital costs with significantly lower operating costs, higher DRE, and improved on-line availability. The demonstrated advantages of the technology helped facilitate the permitting process while providing a total solution for this client's "hard to treat" CVOC abatement application.

Thermatrix Inc.

...Technology Beyond Compliance

Thermatrix Inc.

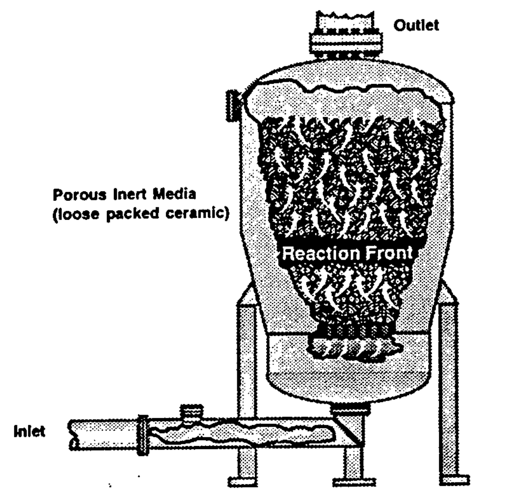
...Technology beyond Compliance

Flameless Thermal Oxidizers for VOC and HAP Control

GS Series: Gas Preheated, "Straight-through" design

Features:
- Guaranteed 99.99% VOC Destruction, including Chlorinated compounds
- Ultra Low NOx...below 2 ppm
- Approved for use in flameproof areas
- Best on fumes with richer VOC concentrations
- Available with top down or bottom up preheat

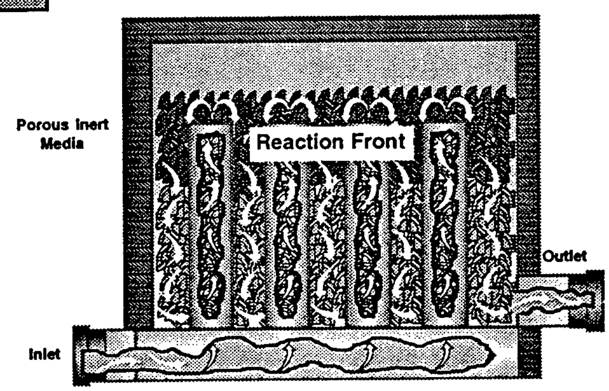
Typical Applications: Process vents, Wastewater treatment, Remediation, Fuel storage and transfer.



GR Series: Gas Preheated, with "Internal Heat Recovery"

Features:
- Guaranteed 99.99% VOC Destruction, including Chlorinated compounds
- Ultra low NOx...below 2 ppm
- Approved for use in flameproof areas
- Best on fume streams with leaner VOC concentrations

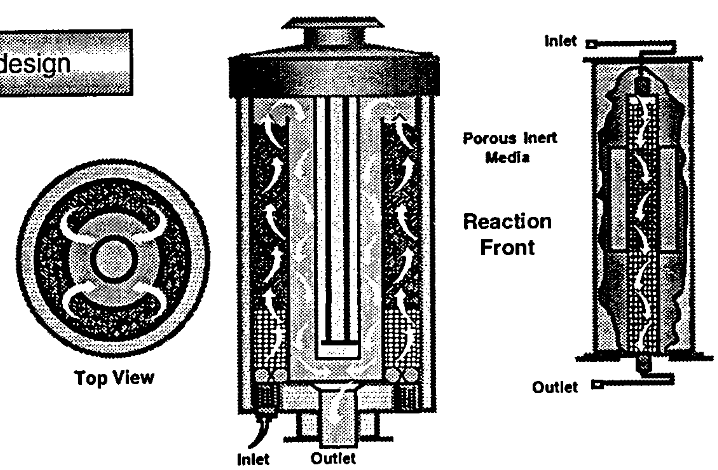
Typical Applications: Process vents, Wastewater treatment, Thermal Desorber off-gas treatment, Paint Booths



ES Series: Electric Preheated, "Straight-through" design

Features:
- Guaranteed 99.99% VOC Destruction, including Chlorinated compounds
- Ultra low NOx...less than 2 ppm
- Approved for use in flameproof areas
- Best on VOC streams below 500 scfm

Typical Applications: Wastewater treatment, Process vents, Fugitive emissions, Remediation



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Thermatrix Technology Description

FLAMELESS THERMAL OXIDATION

TECHNOLOGY BEYOND COMPLIANCE

Thermatrix Inc. has developed an innovative technology which has been field proven to consistently achieve VOC and HAP destruction/removal efficiencies (DREs) of 99.99% or greater. This unique, flameless technology provides safe, cost effective treatment of a wide range of industrial pollutants. Only the Thermatrix process is able to guarantee greater than 99.99% destruction efficiencies *and* ultra low NOx emissions, typically below 2 ppm.

Thermatrix technology exhibits significant advantages over traditional treatment technologies. These advantages allow our clients to take a fundamentally different approach to process emission control. Thermatrix systems, due to their safety and stability, can be located directly in the client's process at the source of emission. This cost effective, pollution prevention approach can dramatically reduce the volume of emissions treated while achieving maximum reduction in overall emissions. Cost savings are realized by the installation of smaller, more energy efficient systems while the high DRE can favorably influence emission averaging and even provide emission credits.

In the Thermatrix process, organic compounds are oxidized in an inert ceramic bed, without flames or catalysts, into harmless carbon dioxide and water vapor or easily neutralized acid gases. While traditional flame-based thermal oxidation relies on the flame for both fume mixing and reaction, the Thermatrix process completely decouples fume mixing from the oxidation reaction. This allows greater flexibility and control and eliminates products of incomplete combustion (PICs). The absence of catalysts also avoids any chance of poisoning or sintering the matrix.

THE MATRIX

The basis for the Thermatrix process is a "porous inert matrix." This matrix fosters conditions necessary to establish a very efficient and stable reaction zone, allowing flameless oxidation of organic compounds outside their respective flammability limits. The rate of oxidation in this matrix is much faster than with traditional treatment technologies, rendering residence time a non-factor. Also, in contrast to catalytic oxidizers, pressure drop across the system is very low due to the high void space ratio (70%) in the matrix.

The three primary attributes of the porous inert matrix that promote flameless oxidation are its interstitial geometry (enhances mixing), thermal inertia (promotes stability), and surface characteristics (augments heat transfer). The thermal properties of the matrix allow the pre-reaction area, or "mixing zone," to be near ambient temperature while the reaction zone is at the appropriate oxidation temperatures.

The properties of the matrix allow for very effective abatement of halogenated organics. Halogenated organics do not effect destruction efficiency or system life, as appropriate corrosion resistant materials are used for each application. Post-reactor acid gas scrubbing can be provided as needed.

Maximum temperatures in the reaction zone remain well below those of a flame, resulting in extremely energy efficient operation with very low formation of thermal NOx. Using a porous inert matrix to support the oxidation reaction results in several performance, safety and process control related advantages.

Thermatrix Inc.

...Technology Beyond Compliance

THE PROCESS

During initial startup of the unit, the matrix is pre-heated and the desired temperature profile is established. Once in profile, the preheater is completely isolated from the system and fume processing can begin. As the fume enters the ambient mixing zone of the reactor, turbulence intimately mixes the hydrocarbons and air. The ambient mixing zone, with its large thermal mass, adds to the safety of the system by acting to prevent flashback. As the well-mixed, ambient stream moves through the matrix it is heated to oxidation temperature as it reaches the reaction zone. The matrix design physically forces the entire fume stream to pass through the reaction zone which ensures complete destruction of the organic compounds and results in consistently high DREs. Heat released by the exothermic oxidation reaction is absorbed by the matrix, providing the thermal momentum needed to maintain the process.

Emissions which vary widely in fume flow and concentration, as in batch chemical manufacturing, are ideally suited for the thermally efficient Thermatrix process. Energy, in the form of heat, is stored in the matrix between peaks in organic loading. This "buffering" capability enables the system to efficiently process fume on very short notice without additional energy input. For intermittent operations, such as those which shut down overnight or on weekends, air flow through the insulated reactor is significantly reduced to help maintain appropriate temperature profile. This operational stand-by, or "ready idle" mode, greatly reduces operating costs and prolongs system life by minimizing thermal cycling.

Control of the Thermatrix oxidizer is simple and straightforward. The same thermal inertia that buffers system reaction to fluctuating process conditions also provides ample response time to control the reaction. Process control components maintain desired operating temperatures by managing the heating value (enthalpy) of the incoming fume. For organic rich or oxygen deficient streams, dilution air is mixed with the fume to maintain the matrix at desired operating temperatures; for lean fume streams, supplemental energy is added to maintain the oxidation reaction. The typical process control scheme is a simple temperature loop controlling the addition of air or fuel to the incoming fume stream.

THE TOTAL SOLUTION

Thermatrix has the experience and expertise to provide total solutions for a wide range of environmental problems. We have designed, installed, and successfully operated full-scale, "turnkey" systems for numerous industrial applications.

Thermatrix systems are simple, robust, highly efficient and can provide unique cost savings not available with more traditional emission control approaches. In many industrial applications, life cycle costs have been field proven to be significantly lower than those of alternative solutions. Whether you need to replace an existing, more expensive technology or control new emissions from expanding production, call us today and let Thermatrix cost effectively take you to the next level...*beyond compliance.*

Thermatrix Inc.

...Technology Beyond Compliance

Flameless Thermal Oxidation

TECHNOLOGY BEYOND COMPLIANCE

COST EFFECTIVE TECHNOLOGY INTEGRATION

Flameless Thermal Oxidation can be effectively utilized over a wide range of organic abatement applications. The unique advantages of the technology make possible cost saving emission control approaches not traditionally associated with VOC abatement. The safety and scalability of the flameless Thermatrix device allows for placement in flameproof areas treating smaller, more concentrated point sources. This, coupled with high DREs, can often significantly reduce the total volume of emissions treated while still attaining overall emission reduction goals.

FLAMELESS THERMAL OXIDATION ADVANTAGES:

- Guaranteed 99.99% DRE, including halogenated organics
- Ultra low NOx... less than 2 ppm
- Destructive process produces no secondary organic waste stream
- Energy efficient operation, self-sustaining down to 10 BTU/cf^3 in fume
- Approved for classified areas... can be located directly at emission source
- Stable operation when responding to variable organic loading
- Matrix is completely inert, with no catalysts to foul
- Superior turndown capability better addresses minimum baseload conditions, reducing operating costs
- Easily permitted... no continuous emission monitoring required
- Creates potential for emission credits

THE TOTAL SOLUTION

Thermatrix has the engineering experience and expertise to provide a total solution to your environmental problem. We specialize in full-scale, "turnkey" VOC abatement systems.

Thermatrix systems are simple, robust, highly efficient and can provide unique cost savings not possible with more traditional emission control approaches. In many industrial applications, life cycle costs have been field proven to be significantly lower than alternative solutions. Whether you need to replace an existing, more expensive technology or control new emissions from expanding production, call us today and let Thermatrix cost effectively take you to the next level...*beyond compliance.*

Thermatrix Inc.

...Technology Beyond Compliance

Applications of Thermatrix Flameless Oxidation Technology in the Treatment of VOCs and Hazardous Wastes

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APPLICATIONS OF THERMATRIX FLAMELESS OXIDATION TECHNOLOGY IN THE TREATMENT OF VOCS AND HAZARDOUS WASTES

Robert G. Wilbourn
Marshall W. Allen
and
Alexander G. Baldwin

Thermatrix Inc.

ABSTRACT

The Thermatrix thermal oxidation technology is a unique, flameless oxidation process that is accomplished in a packed-bed inert matrix. In just over two years of commercial application the technology has been shown effective in destroying a wide variety of organic compounds including chlorinated and sulfonated hydrocarbons. Performance testing conducted to date demonstrates the technology is capable of achieving destruction and removal efficiencies (DREs) in excess of 99.99% with the concurrent production of extremely low quantities of thermal NO_x and carbon monoxide.

The technology has been successfully applied in the treatment of: chlorinated hydrocarbons separated from waste water, fugitive emissions from spray painting operations, and volatile organic compound (VOC) emissions from refinery operations. This year successful treatment and remediation applications of the emerging Thermatrix oxidation technology have been extended. Current technology development and application project activities include: the treatment of VOCs and chlorinated organic compounds separated from contaminated soils, the processing of off-gases containing total reduced sulfur (TRS) compounds, the abatement of chemical vapor releases from manufacturing and refinery operations and on-going technology demonstrations at DOE and DOD sites.

This paper presents and summarizes: current technology development activities, advances in the design of treatment systems based on the Thermatrix thermal oxidation technology, and performance achievements in system operations at multiple project sites.

INTRODUCTION

The Thermatrix technology is a unique, proprietary, patented technology for the flameless thermal oxidation of noxious emissions which arise the normal course of operations in the oil and gas, chemical, pharmaceutical, manufacturing and environmental remediation industries. Thermatrix pioneered its thermal oxidation technology for the highly efficient, controlled, non-flame oxidation of VOCs in a ceramic matrix called a "packed bed". [1] The oxidation of organics occurs in a "reaction zone" contained within the bed of chemically inert ceramic materials typically operated at 1600-1850°F.

In its simplest form, the packed-bed device, shown in Figure 1, consists of an insulated cylinder containing a heated ceramic matrix. In operation, the VOC stream, and any air required to support the oxidation reaction is passed into the bottom of the preheated bed and moves upward through the matrix The temperature of the incoming gas rises as it picks up heat from the bed until the oxidation temperature of the organic is attained. Once the reaction temperature has been reached, the organics in the VOC stream oxidize creating a stabilized reaction zone as heat is given up to the surrounding matrix. The large thermal mass of the bed also enables it to store or release large amounts of heat without rapid changes in temperature. In many cases the VOC stream may already contain adequate heating value to sustain the bed temperatures. If needed, supplemental energy can be provided from either an electrical heater or by enriching the mixture with natural gas or propane.

Figure 2 schematically presents a basic technology enhancement, i.e., internal oxidation heat recuperation. Heat recuperation in a Thermatrix thermal oxidation unit is accomplished by flowing the incoming and exiting gases counter-currently with metal tube separation.[2] In this manner, heat produced during oxidation of the organic constituents is used to raise the temperature of the incoming gas mixture. This style of reactor provides operational and economic process advantages especially in the treatment of highly energetic feed streams, e.g., those streams containing organic compounds in concentrations near the lower explosive limit (L.E.L.).

TECHNOLOGY APPLICATIONS AND TEST RESULTS

Wastewater Treatment

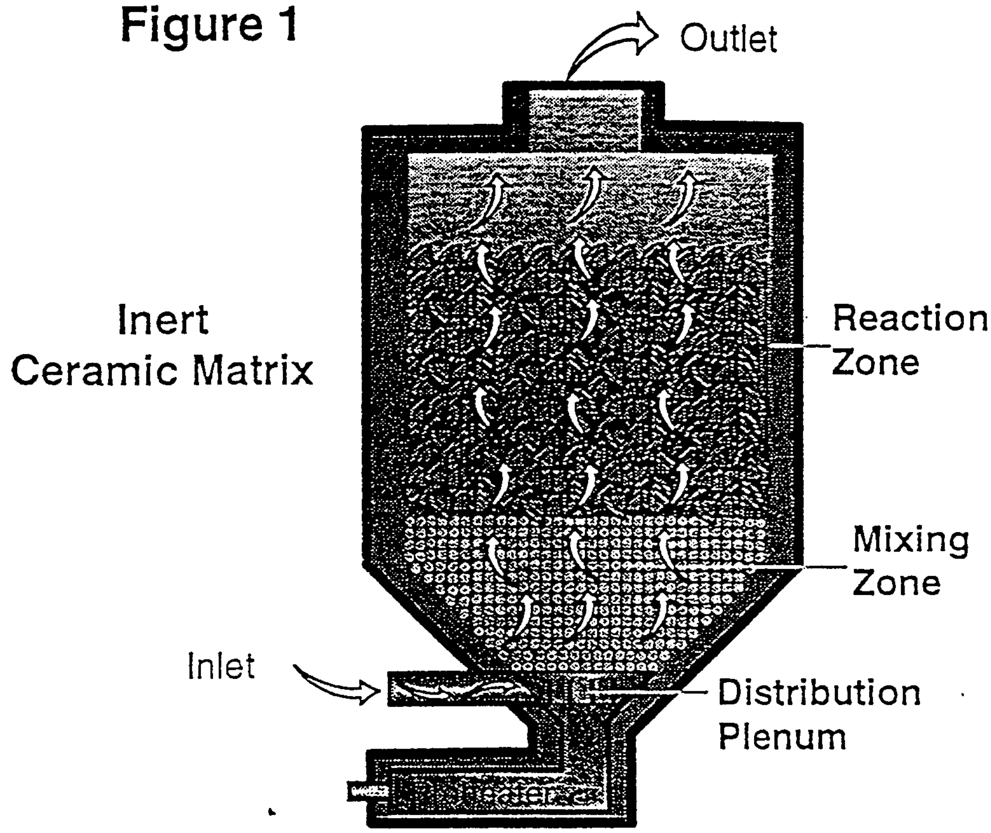
In an effort to voluntarily reduce emissions, a chemical company identified a wastewater stream as a significant source of uncontrolled emissions. The wastewater is generated by steam jet eductors from a vacuum column used in a chemical manufacturing process. The condensed steam from the jet eductors is contaminated with 530 ppmw of ethyl chloride and smaller quantities of butyl chloride, benzyl chloride and non-chlorinated organics, primarily toluene.

The wastewater treatment project was on an extremely aggressive time line to meet corporate emission reduction deadlines. The project scope provided for the design, manufacture, and pre-assembly of a complete unitized, skidded system in less than eight weeks to allow on-site installation, commissioning and start-up to be completed within four weeks.

Thermatrix designed, fabricated and supplied a 100 scfm electrically heated reactor as part of the work scope for this client. The reactor was integrated into an abatement system consisting of an air stripper, knock-out pot, flameless oxidizer, HCl scrubbing system and fully automated controls.

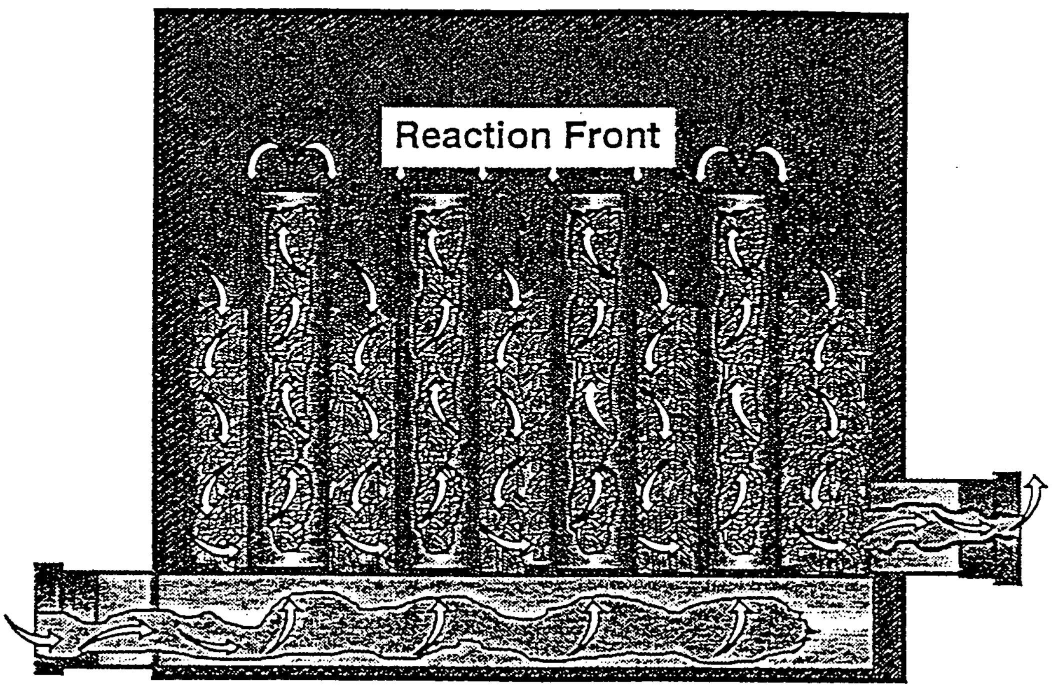
Flameless Thermal Oxidizer

Figure 1



Flameless Thermal Oxidizer with Internal Heat Recovery

Figure 2



Approximately 50 gpm of wastewater is admitted to the air stripping column that is designed to remove 99.9% of the volatiles and produce a moist air stream containing the organics. The cleaned water is recycled to the plant, while the 100-scfm stripper off-gas is conveyed through a knock-out pot and demister before entering the flameless oxidizer, where 99.99% destruction of the organics has been demonstrated achievable. The oxidation reaction produces CO_2, H_2O and HCl. Upon exiting the oxidizer, the gases are quenched and admitted to the scrubbing tower, where 99% of the HCl gas is removed. The scrubber water is discharged from the system to the plant waste water system and the organic-free and acid-free gases exit the scrubber to atmosphere.

To minimize the on-site work scope, the treatment system was designed and pre-assembled complete with all piping, instrumentation and electric power systems. The on-site scope required only completing the few process piping tie ins, terminating a single power feeder and multi-conductor control cable, and erecting the stripping and scrubbing towers which are too tall to be transported in place. Pile foundations, field piping and electrical runs and certain site improvements were completed while the system was being manufactured.

The system was installed, started-up and commissioned without any significant delays. The system has been operating successfully since January 1993. The air permit for the system was issued by state authorities in 30 days.

Refinery Applications

API Separator Emission Treatment

A petroleum refining company contracted with Thermatrix to provide a thermal oxidation system which utilizes a recuperative unit to abate the hydrocarbon emissions from two American Petroleum Institute (API) separators. The project was driven by benzene National Emission Standards for Hazardous Air Pollutants (NESHAP's) for wastewater treatment (40 CFR 61, Subpart FF). A client obtained extension required that the facility be in full regulatory compliance by January 1995.

The project called for Thermatrix to provide a complete skid mounted system with internal heat recovery efficiency of no less that 65%. The thermal oxidation system treats the vapors from several locations in the plant which are manifolded into the suction of two sets of blowers and ducted to the thermal oxidation system. These sources include: two API oil/water separator covers and a number of skimmed oil sumps and slop oil tanks. Figure 3 is a process flow sheet overview of this application.

Thermatrix provided a modularized thermal oxidation system with a stack. Figure 4 shows the system general arrangement. The system is capable of processing 1250 scfm of plant emissions. Preliminary performance results are presented in Table 1 and demonstrate the capability of the system to meet established performance criteria.

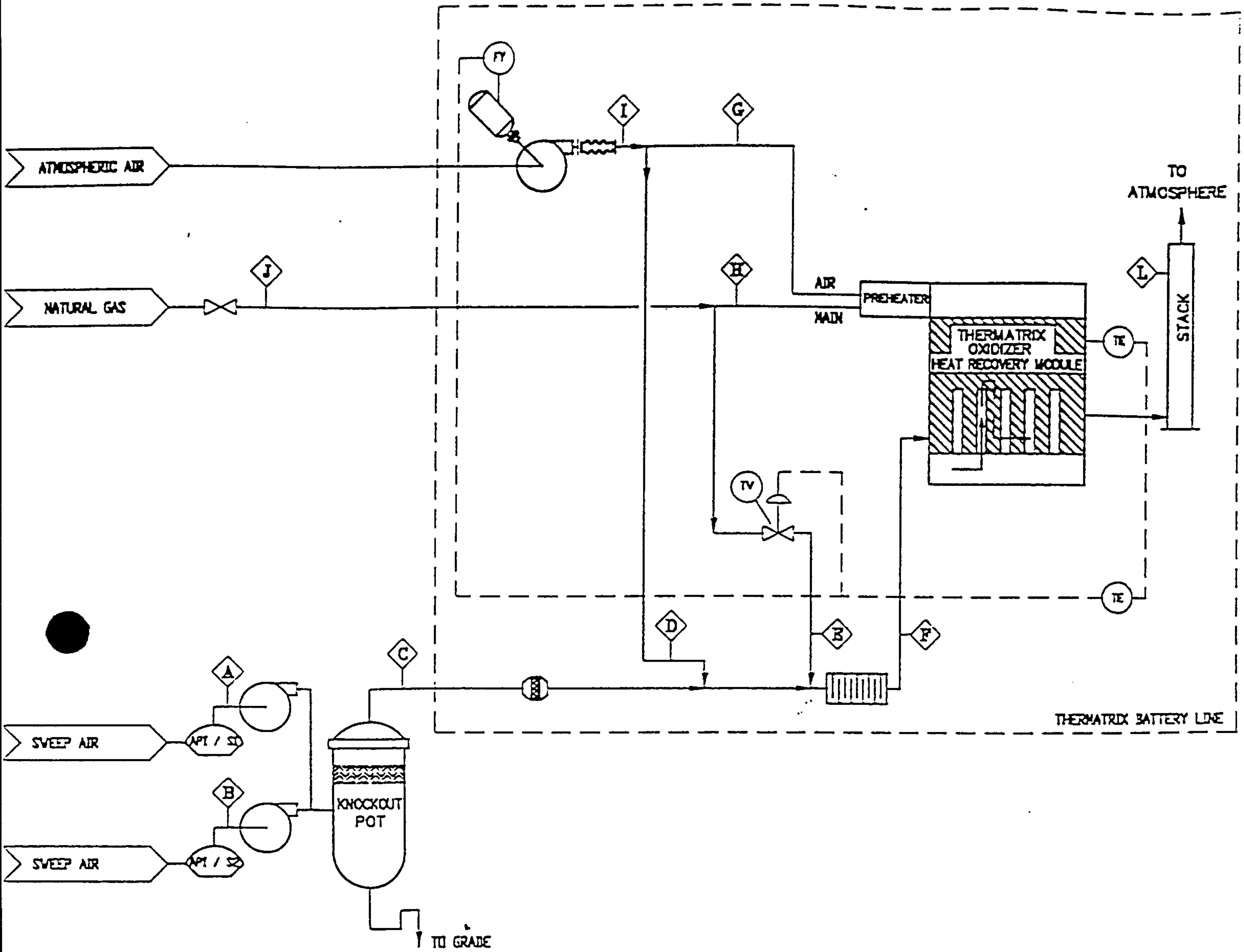


FIGURE 3

REFINERY API SEPARATOR EMISSION TREATMENT
PROCESS FLOW DIAGRAM

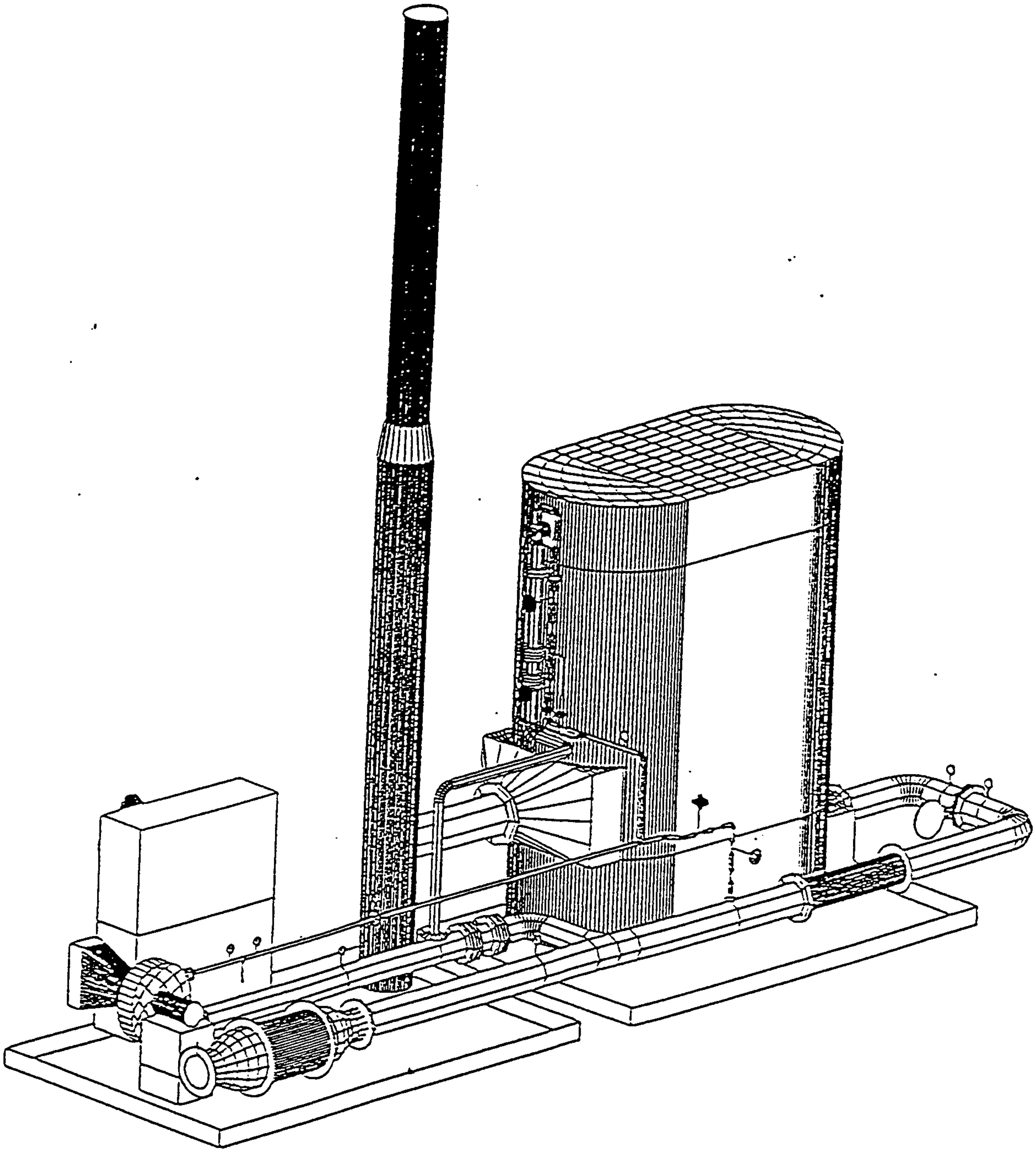


FIGURE 4

REFINERY API SEPARATOR EMISSION TREATMENT SYSTEM
GENERAL ARRANGEMENT

Table 1
Performance Summary
Thermatrix Oxidizer Treating API Separator Emissions

Sample	Total HC (ppmv)	% DRE	CO (ppmv)	$\%CO_2$	$\%O_2$	$\%N_2$	$\%CH_4$
Inlet	5200		<10	0.091	21	78	0.027
Outlet	(<5) ND	>99.9	<10	2.1	19	79	<0.0002

Oil Recycling

In 1994 Thermatrix supplied a 4000 scfm thermal oxidation unit for use in an oil recycling operation. The client for this unit operates a transportable waste-oil recovery facility that manufactures various grades of fuel oil from waste lubricating oils. The manufacturing process consists of several unit operations including a thermal-cracking reactor that continuously vent process gases containing VOCs. Venting results from entrained air, vaporized waste, light hydrocarbon non-condensable gases and controlled process venting. The incorporation of a Thermatrix unit in the processing system mitigates VOC emissions. Additionally, a finned-tube heat exchanger unit is used to recover heat from the hot Thermatrix off-gas to provide process heating requirements. The heat is transferred to a circulating hot oil stream. The cooler off-gas exiting the heat recovery unit is vented to atmosphere through a stack.

Preliminary test results show the composition of the Thermatrix/heat recovery unit off-gas meets the performance criteria established for the project. Performance data are presented in Table 2.

Table 2
Performance Summary
Thermatrix Oxidizer Treating Waste-Oil Recycling VOCs

Sample	Total HC (ppmv)	%DRE	CO (ppmv)	$\%CO_2$	$\%O_2$	$\%N_2$	$\%CH_4$
Inlet #1	6400		34	1.1	19	78	37
Outlet #1	ND (<0.5)	>99.99	ND (<10)	2.9	18	79	ND (0.0002)
Outlet #2	ND (<0.5)	>99.99	ND (<10)	5.1	13	81	ND (0.0002)

Treatment of Pulp Plant Non-Condensable Gases

In the Kraft paper production process a solution containing sodium hydroxide and sodium sulfide is used in the treatment of wood to separate the wood's fiber and lignin components. During pulp plant operations volatile sulfur-bearing VOCs are formed which can be problematic from an emissions control standpoint. A particularly problematic source of sulfur-bearing VOCs associated with paper production is the process non-condensable gases (NCGs) which contain significant quantities of pinene, hydrogen sulfide, methyl mercaptan, dimethyl sulfide and dimethyl disulfide.

In 1994, Thermatrix contracted to deliver a system for the treatment of NCG fumes at a pulp mill. The system is comprised of a gas inlet train, a stainless steel 3000 scfm thermal oxidizer, a quench, a wet scrubber and stack. Figures 5 and 6 schematically present details of the oxidizer and overall system. The system has been installed at the client's site and is currently in the startup and commissioning phase of the project. Initial difficulties were encountered in the startup due to the design placement of the temperature sensing and control thermocouples. These difficulties were largely overcome by relocating the original horizontal thermocouples to a vertical orientation in closer proximity to the reaction zone thereby enabling more accurate temperature monitoring and control.

By the end of February 1995, approximately 400 hours of operation on NCG fumes had been logged. In limited tests the following performance criteria have been demonstrated for the system:

- Destruction and removal efficiency (DRE) for total reduced sulfur (TRS) Compounds > 99.99%
- Sulfur dioxide emission rate of <15 ppm
- Sulfur dioxide (SO_2) removal > 99.96%
- Hydrogen sulfide emission rate < 5 ppm

Treatment of Chemical Plant Chlorinated Volatile Organic Compound Emissions

In January 1995 Thermatrix successfully commissioned a 1500 scfm skid-mounted system consisting of a Hastelloy$^{(R)}$ oxidizer and a quench/scrubber. The system is currently processing methylene chloride emissions generated during the production of pesticides. The system is designed to provide > 99.99% DRE for chlorinated hydrocarbons.

PARTICIPATION IN DOD AND DOE TECHNOLOGY DEMONSTRATION PROGRAMS

The Thermatrix thermal oxidation technology is currently being demonstrated in two government-sponsored innovative technology demonstration programs. The elements of these programs are presented below:

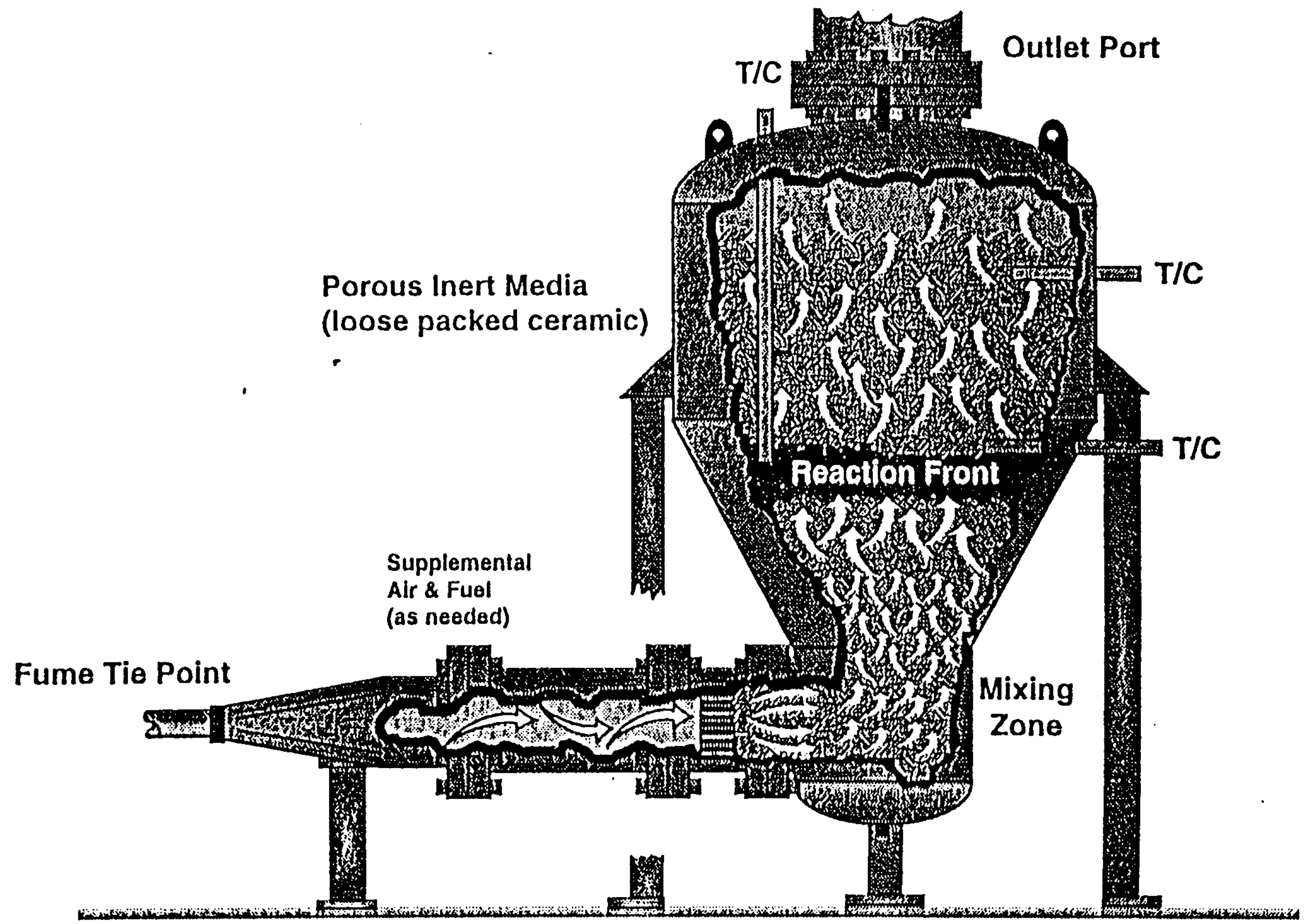


Figure 5
Cutaway Drawing of GS-3000M Reactor
Treatment of Pulp Mill Non-Condensable Gases

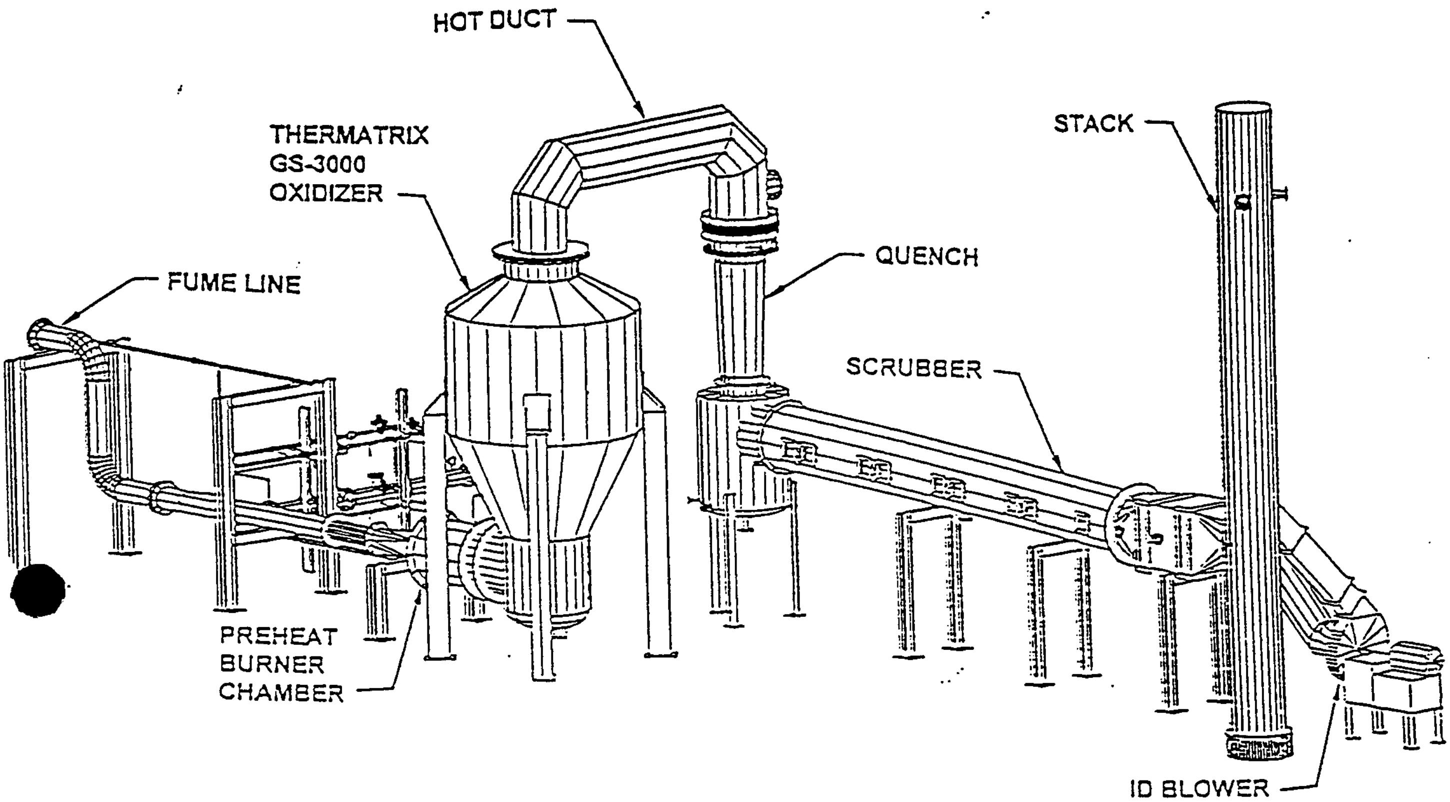


FIGURE 6

PULP PLANT NON-CONDENSABLE
GAS TREATMENT SYSTEM

U.S. Navy

Thermatrix has contracted with the Navy under its Navy Environmental Leadership to demonstrate the effectiveness of the thermal oxidation technology in treating VOC emissions from the fuel farm at the Naval Air Station North Island (NASNI). A 5 scfm electrically heated oxidizer has fabricated for use in this demonstration. The demonstration will be performed in April 1995.

Department of Energy

The Thermatrix technology is applicable to the in-situ and ex-situ treatment of soils contaminated with organic compounds thorough coupling with other technologies, e.g., soil vapor extraction and thermal desorption.[3] Thermatrix will demonstrate its thermal oxidation in the treatment of chlorinated VOCs removed from the vadose zone of the soil at the U. S. Department of Energy Savannah River Laboratory Site. A 5 scfm electrically heated unit will be used in this demonstration which couples soil vapor extraction technology with Thermatrix thermal oxidation technology. A schematic overview of planned demonstration is shown in Figure 7.

CONCLUSIONS

The successful application case histories presented above attest to the broad base of Thermatrix's thermal oxidation technology in providing solutions to organic compound treatment and site remediation. With over 30 projects completed to date, the Thermatrix thermal oxidation technology has rapidly transitioned from an innovative, emerging technology to full-scale application.

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3. R. G. WILBOURN, et.al., "Treatment of Hazardous Wastes Using the Thermatrix Treatment System," presented at the 1994 Incineration Conference, May 9-13, 1994, Houston, Texas.

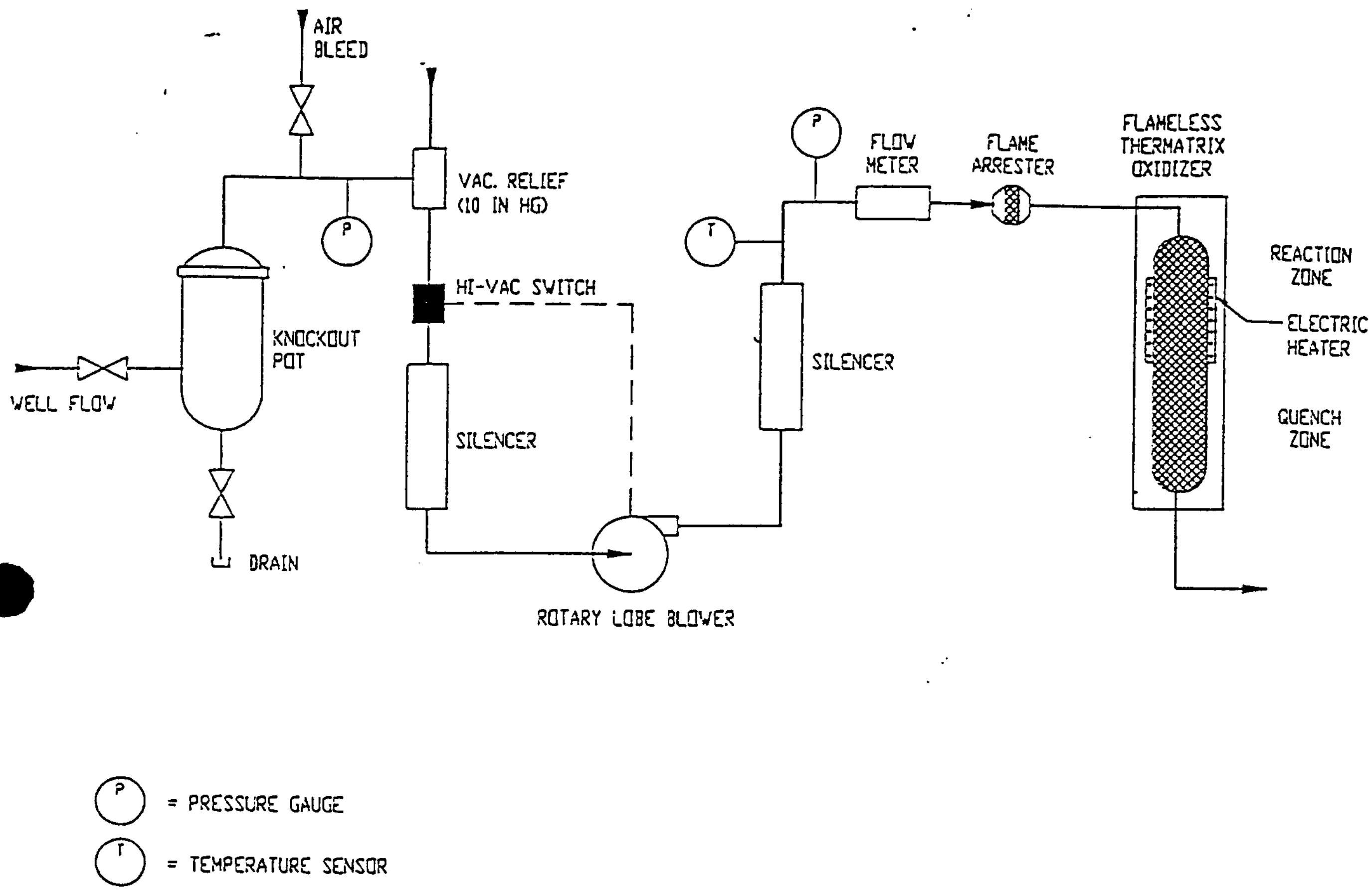

FIGURE 7

SCHEMATIC OVERVIEW OF THE SVE-THERMATRIX DEMONSTRATION

WESTINGHOUSE SAVANNAH RIVER DEMONSTRATION
INITIAL RESULTS

FTO Temp	FTO Flow	PCE inlet ppm	PCE outlet ppm	PCE %DRE	TCE inlet ppm	TCE outlet ppm	TCE %DRE ppm	TCA inlet	TCA outlet	TCA %DRE	Comments
1600°F	5 scfm	737 702	<0.01 <0.01	>99.998 >99.998	292 274	<0.01 <0.01	>99.996 >99.996	17.5 21.4	<0.01 <0.01	>99.94 >99.95	1,1-DCE 5.56 in; <0.01 out
1600°F	7 scfm	568	0.17	99.97	255	<0.01	>99.996	16	<0.01	>99.95	1,1-DCE 4.72 in; <0.01 out
1500°F	5 scfm	345	4.43	98.7	184	<0.01	>99.994	16	<0.01	>99.95	
1700°F	5 scfm	343	0.01	99.997	180	<0.01	>99.994	15	<0.01	>99.93	1,1-DCE 4.09 in; <0.01 out; F113 0.03 in; <0.01 out
1400°F	5 scfm	333	0.51	99.84	179	<0.01	>99.994	12	<0.01	99.916	mono-, di-, tri-, tetra-chloro-methane PICS
1500°F	3.5 scfm	~350 ~350	<0.01 0.05	>99.997 99.985	~180 ~180	<0.01 <0.01	>99.994 >99.994	~15 ~15	<0.01 <0.01	>99.93 >99.93	
1600°F	**5 scfm**	**250**	**<0.001**	**>99.9996**	**120**	**<0.001**	**>99.9991**	-------	------	-------	**4/25/95 Improved detection limit achieved**

Notes:

1)Prior to the initial valving of fume through the oxidizer a "system blank" sample was taken while the pre-heated unit (1600°F) was operating on air flow only (5 scfm). No organics were detected at a detection limit of 10 ppb.

2)">" values reflect quantitation limited by the analytical detection limit of 10 ppb for all compounds.

3) Results reported here are from sampling April 10-14, 1995 except for 4/25/95 entry.

APPENDIX B

ANALYTICAL DATA REPORTS 1 THROUGH 7

TABLE 2 (Revised)
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Extraction Time (days)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-6	8/28/96, 1200																Opened VEW/VW-6
VEW/VW-6	8/29/96, 1200																Closed VEW/VW-6
Total Extraction Time - VEW/VW-6					1	24											
MW-108	8/29/96, 1200																Opened MW-108
MW-108		9/2/96	15:30	NA	3.15	76	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
MW-108	9/06/96, 1200				7.00	168											Closed MW-108
Total Extraction Time - MW-108					7	168											
VEW\VW-6	9/06/96, 1200																Opened VEW/VW-6
VEW\VW-6	9/07/96, 1200				1	24											Estimated System Shutdown Time/Date
VEW\VW-6	9/9/96																System shutdown was identified on Sept 9 due to electrical failure; sample not collected
Total Extraction Time - VEW/VW-6					1.0	24											
VEW\VW-5	9/19/96, 1300																Opened VEW/VW-5
VEW\VW-5		9/25/96	1435	NA	6.1	145.5		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW/VW-5	9/28/96, 1200				9.0	215.0											Estimated Shutdown time/date
VEW\VW-5	9/30/96																Shutdown identified Sept 30 , electrical failure
VEW\VW-5	10/2/96, 0900																System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96, 1200				1.13	27											Estimated Shutdown time/date
VEW\VW-5	10/3/96																System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96, 1050																System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/7/96, 1200				2.13	51											Estimated Shutdown time/date, accidental shutdown by electrician
VEW\VW-5	10/10/96																System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96,0915																System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430			96	4.21	101											Closed VEW/VW-5
Total Extraction Time - VEW/VW-5					16.4	394											
VEW/VW-6	10/14/96, 1500																Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.02	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	0.7	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	1.2	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	2.0	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	5.8	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324			240.00	10.0	474.75								0			System shutdown due to high temp alarm.

TABLE 2 (Revised)
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Extraction Time (days)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
Total Extraction Time - VEW/VW-6					19.8	474.75											
VEW/VW-7	12/6/96,0845																System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	0.1	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	3.0	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200			0.75	0.03	75.25											Closed VEW/VW-9
Total Extraction Time - VEW/VW-7					3.1	75.25											
VEW/VW-14	12/9/96,1212																Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	0.1	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	3.9	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200			0.92	0.04	95.81											Closed VEW/VW-14
Total Extraction Time - VEW/VW-14					4.0	95.81											
VEW/VW-8	12/13/96,1208																Opened VEW/VW-8
VEW/VW-8	12/16/96,1612					73.07											System Shutdown
VEW/VW-8	12/17/96,1430																System Restart
VEW/VW-8		12/18/96	1130	NA	3.9	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225					165.08											Closed VEW/VW-8 to remove ice blockage
VEW/VW-8	12/24/96,0820																Opened VEW/VW-8
VEW/VW-8		12/24/96	930	72.18	3.0	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000					166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	3.1	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400			0.50	0.02	242.25											Closed VEW/VW-8
Total Extraction Time - VEW/VW-8					10.1	242.25											
							DEC	21.5									
VEW/VW-9	12/27/96,1500																Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	0.50	0.02	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	6.84	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130			0.25	0.01	165.00											Closed VEW/VW-9
Total Extraction Time - VEW/VW-9					6.9	165.00											
VEW/VW-12	1/3/97, 1150																Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	4.08	0.17	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	3.71	93.08											Closed VEW/VW-12
Total Extraction Time - VEW/VW-12					3.9	93.08											

TABLE 2 (Revised)
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Extraction Time (days)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-13	1/7/97, 1505																Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	0.92	0.04	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	6.70	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	0.01	162.00											Closed VEW/VW-13
Total Extraction Time - VEW/VW-13					**6.8**	**162.00**											
VEW/VW-10	1/14/97, 1020																Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	4.72	0.20	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	3.23	82.17											System shutdown due to weather-related low propane pressure.
Total Extraction Time - VEW/VW-10					**3.4**	**82.17**											
-	1/21/97, 1515																System operational, TIC-315 control setpoint changed to 1200deg.F
	1/22/97, 0400			13.25	0.55												System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634																System operational
VEW/VW-3	1/22/97, 1708																Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	1.67	0.07	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300				4.34	105.92											System shutdown due to weather-related low propane pressure.
Total Extraction Time - VEW/VW-3					**4.41**	**105.92**											
	1/27/97, 1600																System operational
VEW/VW-4	1/27/97, 1825																Opened VEW/VW-4
VEW/VW-4		1/27/97	2030	2.10	0.09	2.10	94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected
VEW/VW-4		2/3/97	1225	159.90	6.66	162.00	114	47.9	52.1	100	1200	7.7	8.7	575	14.5	4.7	Sample collected
VEW/VW-4	2/3/97, 1235					162.00											Closed VEW/VW-4
Total Extraction Time - VEW/VW-4					**6.75**	**162.00**											
VEW/VW-2	2/3/97, 1305																Opened VEW/VW-2
VEW/VW-2		2/3/97	1507	2.03	0.08	2.03	114	82.4	17.6	100	170	17.5	3.7	140	18.7	2.5	Sample Collected
VEW/VW-2		2/4/97	1301	21.90	0.91	24.00	109	80.4	19.6	100	230	18	3.5	185	19.3	2.3	Sample Collected
VEW/VW-2	2/4/97, 1325					24.50											Closed VEW/VW-2
Total Extraction Time - VEW/VW-2					**1.02**	**24.50**											
VEW/VW-11	2/5/97, 1350																Opened VEW/VW-11
VEW/VW-11		2/5/97	1452	1.03	0.04	1.03	109	75.0	25.0	100	160	19.7	2	120	20.3	1.3	Sample Collected
VEW/VW-11		2/7/97	1117	44.40	1.85	45.43	110	75.0	25.0	100	160	20.2	1.7	120	20.7	0.8	Sample Collected
VEW/VW-11	2/7/97, 1148			0.50	0.50	45.93											Closed VEW/VW-11
Total Extraction Time - VEW/VW-11					**1.91**	**45.93**											

TABLE 2 (Revised)
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Extraction Time (days)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-6&14	2/7/97, 1204																Opened VEW/VW-6&14
VEW/VW-6&14		2/7/97	1310	NA	0.05	1.10	110	63.3	36.7	100	1500	6.7	10.8	950	14.7	5.7	Sample Collected
VEW/VW-6&14		2/19/97	0906	283.90	11.83	285.00	130	75.4	24.6	100	3050	9.9	7.8	2300	13.8	5.7	Sample Collected
VEW/VW-6&14		2/21/97	1200	61.10	2.55	337.10	113	63.5	36.5	100	2600	11	7.2	1650	15.8	4.2	Sample Collected
VEW/VW-6&14		2/24/97	0839	68.70	2.86	405.80	106	63.9	36.1	100	1800	11.1	7.2	1150	17	3.7	Sample Collected
VEW/VW-6&14		3/5/97	1630	224.20	9.34	630.00	112	60.0	40.0	100	3500	12	6.5	2100	17.1	3.1	Sample Collected, QA,QC samples collected
VEW/VW-6&14		3/6/97	1030	18.00	0.75	648.00	106	66.7	33.3	100	3900	11.8	6.5	2600	15.8	4	Sample Collected
VEW/VW-6&14	3/6/97, 1245				0.09	650.25											Closed VEW/VW-14
Total Extraction Time - VEW/VW-6&14					**27.09**	**650.25**											
VEW/VW-6	3/6/97,1300																Operating exclusively on VEW/VW-6
VEW/VW-6		3/11/97	1530	122.50	5.10	122.50	118	66.7	33.3	100	4200	14	5.5	2800	16.8	3.3	Sample Collected
VEW/VW-6	3/12/97, 1521																System Shutdown. Sample pump shorted out system.
VEW/VW-6	3/14/97, 2347																System Restart, Operating on VEW/VW-6
VEW/VW-6		3/18/97	1625	112.50	4.69	235.00	146	89.7	10.3	100	3900	15.2	4.5	3500	16	4	Sample Collected
VEW/VW-6	3/18/97, 1700					235.50											Closed VEW/VW-6
Total Extraction Time - VEW/VW-6					**9.81**	**235.50**											
VEW/VW-14	3/18/97, 1715																Opened VEW/VW-14
VEW/VW-14		3/19/97	1645	23.50	0.98	23.50	150	62.5	37.5	100	640	15.9	4	400	18	2.1	Sample Collected
VEW/VW-14		3/20/97	1720	24.40	1.02	47.90	148	74.6	25.4	100	590	13.8	4.1	440	16.9	2.6	Sample Collected
VEW/VW-14		3/25/97	1337	116.30	4.85	164.20	140	78.7	21.3	100	375	16.7	3.9	295	18.3	2.6	Sample Collected
VEW/VW-14	3/25/97, 1420					165.00				0.0							Closed VEW/VW-14, Final System Shutdown
Total Extraction Time - VEW/VW-14					**6.88**	**165.00**											

F.C. 728414.04000
Job Files
Analytical Data Report

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc P. [illegible]
M Vessely
D Downey
G. Cyr.

April 14, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 7, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2, and 3 which constitute Analytical Data Report No. 7 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of March 1997, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO demonstration at this site has been completed and the FTO unit was shut down at 13:57 hours on March 25, 1997, and removed from the site at 13:00 hours on March 27, 1997. The March samples were collected using the revised sampling procedures described in Parsons ES's March 13, 1997 letter to Mr. Chuck Wright (Thermatrix, Inc.) (see Attachment 1). The destruction efficiency of the FTO Unit, calculated using March 1997 data, exceeded 99.87 percent of all targeted compounds. This data report is being sent within 4 working days of receipt of the final analytical laboratory results report. The March 1997 data represent the following FTO treatment unit operating conditions:

- On March 5, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during the sample collection. Results for these samples are used to evaluate the efficiency of the FTO treatment unit to destroy volatile organic compounds (VOCs) in a gas stream that is a mixture of fuel hydrocarbons and chlorinated solvents. Well VE/VW-6 was selected because it had the highest detected total volatile hydrocarbon (TVH) concentration (6,000 ppmv), and the lowest oxygen concentration (0 percent initially), and well VE/VW-14 was selected because it had a high detected trichlorethene (TCE) concentration (35 ppmv).

- On March 6, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during the sample collection. Following sample collection, Parsons ES switched the FTO treatment unit to begin treating and extracting vapors from well VE/VW-6 only. This well was selected to evaluate the efficiency of the FTO treatment unit to treat a VOC vapor stream that is primarily contaminated with fuel hydrocarbons.

- On March 11, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-6 during the sample collection.

- On March 12, 1997, at 15:21 hours, the FTO treatment unit shutdown during sample collection. An electrical short in the sampling pump caused the unit to shut down. The unit was restarted on March 14, 1997 at 23:47 hours, and continued to extract and treat vapors from well VE/VW-6. Therefore, the unit was down for a total of 56.50 hours.

- On March 18, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-6 during the sample collection. Following sample collection, Parsons ES switched the FTO treatment unit to begin treating and extracting vapors from well VE/VW-14 only. This well was selected to evaluate the efficiency of the FTO treatment unit to destroy a VOC vapor stream contaminated primarily with chlorinated solvents.

- On March 19, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collection.

- On March 20, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collection.

- On March 25, 1997, Parsons ES collected final influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collection. Following final sample collection, at 13:57 hours the FTO treatment unit was shut down to begin demobilization of the FTO unit from Plattsburgh AFB.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mike Deaton, HSC/PKVAB (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Chuck Wright, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

ATTACHMENT 1

REVISED SAMPLING PROCEDURES

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax (303) 831-8208

March 13, 1997

Mr. Chuck Wright
Thermatrix, Inc.
308 N. Peters Road, Suite 225
Knoxville, Tennessee 37922

Subject: Air Force Contract No. F41624-94-D-8136, Delivery Order 28
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Thermatrix Sampling Procedure Recommendations for Air Force Unit at Plattsburgh, New York

Dear Mr. Wright:

The purpose of this letter is to provide a response to Mr. Marshall Allen's (Thermatrix, Inc.) memorandum dated February 21, 1997, and Mr. Rick Martin's (Thermatrix, Inc.) memorandum received via facsimile on March 4, 1997, regarding the sampling procedures used by Parsons Engineering Science, Inc. (Parsons ES) to evaluate the performance of the Thermatrix flameless thermal oxidizer (FTO) treatment unit operating at Plattsburgh, New York. Parsons ES agrees that analytical data reported in Analytical Data Reports 1 through 5 cannot be used to accurately determine the destruction removal efficiency (DRE) of the FTO treatment unit because inlet vapor samples were not collected following the addition of dilution air. Parsons ES will be collecting these inlet samples during the next 4 weeks of FTO treatment unit operation following the procedures provided below:

Influent Sampling

The influent vapor stream to the oxidizer will be sampled as follows:

Location: Influent to the oxidizer, exhaust side of the blower, combined vapor stream location.

Procedure: Using a new Tedlar® bag, connect the bag with a new short piece of Tygon® tubing to the combined sampling port. Open the valve on the sampling port to allow the Tedlar® bag to fill. Fill and evacuate the bag three times prior to collecting a sample. Once the Tedlar® bag is purged three times, fill the bag a final time, and collect a sample. Following sample collection, close both the Tedlar® bag and sampling port valve, before removing the bag from the sampling port.

Preparing the SUMMA® canister will consist of testing its vacuum both prior to (initial) and following sample collection. Once the initial vacuum is checked, the filled Tedlar® bag will be connected to a 1-liter SUMMA®canister. The bag valve will be opened, and then the SUMMA® canister valve will be opened slowly to allow the Tedlar® bag sample to enter the SUMMA® canister. Once the canister is full, the valve will be closed, and the SUMMA® canister will be prepared for shipment. SUMMA® canister filters will not be needed during influent sampling.

Effluent Sampling

The effluent vapor stream to the oxidizer will be sampled as follows:

Location: Oxidizer effluent within the center of stack opening approximately 6 inches below the top of the stack.

Procedure: Place the copper tubing into the stack so that one end is approximately 6 inches below the top of the stack and located in the center of the stack annulus. Connect a 1-cfm sampling pump to the other end of the copper tubing via Tygon® tubing to purge the tubing. An inline "tee" is placed approximately 3 feet from the top of the oxidizer exhaust within the copper tubing from which the SUMMA® canister sample will be collected. After purging the sample tube for at least 15 to 30 seconds, and continuing to purge using the 1-cfm pump, the SUMMA® canister sample will be collected through the inline "tee" via a short piece of dedicated rigid copper tubing fitted with the appropriated adapters in order to attach the SUMMA® canister. At this sample collection point a new, laboratory-supplied, prefilter will be attached to the canister inlet to prevent any particulates or moisture from entering the canister. Once the canister is completely evacuated, the valve will be closed, and the canister will be prepared for shipment.

Quality Control Sampling

Prior to the first sampling event, a quality control (QC) effluent sample will be collected from the copper sampling tube. The QC sample will be collected in the field next to the system and would be considered a combination field and equipment blank. This SUMMA® canister sample will identify whether the tubing or ambient air could be contributing to any VOC detections in the effluent sample. The copper tubing will be purged a minimum of 15 seconds with ambient air using the 1-cfm pump prior to sample collection.

Parsons ES appreciates Thermatrix, Inc.'s comments and time that Marshall Allen and Rick Martin have taken to discuss the sampling procedures with Steve Archabal (Parsons ES, Site Manager).

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest, P.E.
Project Manager

cc: Marshall Allen, Thermatrix, Inc.
Rick Martin, Thermatrix, Inc.
Jim Gonzales, AFCEE/ERT
Mr. Brady Baker, AFBCA/OL3A
Mr. Ken Kukkonen, OHM
Mr. Rich Jasaitis, OHM
Doug Downey, Parsons ES-Denver
Steve Archabal, Parsons ES-Phoenix
Dave Brown, Parsons ES-Syracuse
File 728414

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
MARCH 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a]						
Analyte	Influent Sample FT002VW6&14C1 3/5/97	Effluent Sample FT002VW6&14EN1 3/5/97	Destruction Efficiency (percent)	Ambient Sample FT002BLANK-1 3/6/97	Influent Sample FT002VW6&14C2 3/6/97	Effluent Sample FT002VW6&14EN2 3/6/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	6800	ND[b]	100	760	11000	ND	100.00
1,2-Dichlorobenzene	ND	ND	NA	14	ND	ND	NA
1,3,5-Trimethylbenzene	4100	ND	100	390	6700	ND	100.00
1,4-Dichlorobenzene	ND	ND	NA	5	ND	ND	NA
4-Ethyltoluene	5800	ND	100	520	9000	ND	100.00
Benzene	3700	ND	100	12	5200	5	99.90
cis-1,2-Dichloroethene	60000	ND	100	140	80000	55	99.93
Ethyl Benzene	920	ND	100	36	1400	ND	100.00
Freon 113	ND	ND	NA	ND	ND	ND	NA
Heptane	58000	ND	100	90	85000	60	99.93
Hexane	50000	ND	100	22	70000	21	99.97
m,p-Xylene	24000	ND	100	1100	35000	33	99.91
o-Xylene	14000	ND	100	790	21000	20	99.90
Tetrachloroethene	ND	ND	NA	ND	ND	ND	NA
Toluene	21000	ND	100	300	29000	38	99.87
Trichloroethene	12000	ND	100	73	16000	19	99.88
THC[d]	1500000	ND	100	12000	1700000	860	99.95

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TABLE 1 (Continued)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
MARCH 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)								
Analyte	Influent Sample FT002VW6&14C2 DUP 3/6/97	Effluent Sample FT002VW6&14EN2-DUP 3/6/97	Destruction Efficiency (percent)	Influent Sample FT002VW6C1 3/11/97	Effluent Sample FT002VW6EN1 3/11/97	Destruction Efficiency (percent)	Influent Sample FT002VW6C2 3/18/97	Effluent Sample FT002VW6EN2 3/18/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	9900	280	97.17	11000	7	99.94	5900	ND	100.00
1,2-Dichlorobenzene	ND	ND	NA	ND	ND	NA	ND	ND	NA
1,3,5-Trimethylbenzene	6300	160	97.46	7600	5	99.93	4600	ND	100.00
1,4-Dichlorobenzene	ND	ND	NA	ND	ND	NA	ND	ND	NA
4-Ethyltoluene	8300	220	97.35	9300	ND	100.00	9000	ND	100.00
Benzene	ND	8	NA	5000	ND	100.00	7100	ND	100.00
cis-1,2-Dichloroethene	83000	98	99.88	80000	7	99.99	120000	ND	100.00
Ethyl Benzene	1300	19	98.54	1500	ND	100.00	1700	ND	100.00
Freon 113	ND	ND	NA	ND	ND	NA	ND	ND	NA
Heptane	82000	75	99.91	94000	ND	100.00	99000	ND	100.00
Hexane	72000	ND	100.00	80000	ND	100.00	82000	ND	100.00
m,p-Xylene	33000	540	98.36	40000	14	99.97	38000	ND	100.00
o-Xylene	20000	380	98.10	24000	9	99.96	19000	ND	100.00
Tetrachloroethene	ND	ND	NA	ND	ND	NA	ND	ND	NA
Toluene	29000	180	99.38	30000	6	99.98	35000	ND	100.00
Trichloroethene	16000	45	99.72	15000	4	99.97	22000	ND	100.00
THC	2400000	5000	99.79	2300000	1400	99.94	2600000	ND	100.00

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TABLE 1 (Continued)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
MARCH 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)									
Analyte	Influent Sample FT002VW14C1 3/19/97	Influent Sample FT002VW14C1 DUP 3/19/97	Effluent Sample FT002VW14EN1 3/19/97	Destruction Efficiency (percent)	Influent Sample FT002VW14C2 3/20/97	Effluent Sample FT002VW14EN2 3/20/97	Destruction Efficiency (percent)	Influent Sample FT002VW14C3 3/25/97	Effluent Sample FT002VW14EN3 3/25/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	760	810	7	99.08	220	ND	100.00	ND	ND	NA[d]
1,2-Dichlorobenzene	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA
1,3,5-Trimethylbenzene	460	560	ND	100.00	150	ND	100.00	ND	ND	NA
1,4-Dichlorobenzene	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA
4-Ethyltoluene	700	780	ND	100.00	ND	ND	NA	ND	ND	NA
Benzene	ND	ND	9	NA	ND	ND	NA	ND	ND	NA
cis-1,2-Dichloroethene	1700	1600	ND	100.00	1600	ND	100.00	1900	ND	100.00
Ethyl Benzene	ND	ND	16	NA	160	ND	100.00	ND	ND	NA
Freon 113	180	140	ND	100.00	140	ND	100.00	99	ND	100.00
Heptane	2500	2900	31	98.76	2200	ND	100.00	ND	ND	NA
Hexane	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA
m,p-Xylene	1100	1000	22	98.00	460	ND	100.00	ND	ND	NA
o-Xylene	650	710	8	98.77	230	ND	100.00	200	ND	100.00
Tetrachloroethene	220	180	ND	100.00	240	ND	100.00	320	ND	100.00
Toluene	300	340	38	87.33	280	ND	100.00	ND	ND	NA
Trichloroethene	31000	31000	ND	100.00	24000	ND	100.00	19000	ND	100.00
THC	170000	130000	240	99.86	83000	ND	100.00	98000	ND	100.00

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See Table 3 for field measurements and system operating conditions at the time of sampling.

[c] ND = Not detected.

[d] NA = Not applicable.

[e] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

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TABLE 2
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW- and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected

TABLE 2
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	93.08											Closed VEW/VW-12
VEW/VW-13	1/7/97, 1505															Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	NA	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	162.00											Closed VEW/VW-13
VEW/VW-10	1/14/97, 1020															Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	NA	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	82.17											System shutdown due to weather-related low propane pressure.
-	1/21/97, 1515															System operational, TIC-315 control setpoint changed to 1200deg F
	1/22/97, 0400															System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634															System operational
VEW/VW-3	1/22/97, 1708															Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	NA	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300															System shutdown due to weather-related low propane pressure.
	1/27/97, 1600															System operational
	1/27/97, 1825															Opened VEW/VW-4
VEW/VW-4		1/27/97	2030	NA	2.10	94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected
VEW/VW-4		2/3/97	1225	159.90	162.00	114	47.9	52.1	100	1200	7.7	8.7	575	14.5	4.7	Sample collected
VEW/VW-4	2/3/97, 1235															Closed VEW/VW-4

TABLE 2

FIELD MEASUREMENTS

FOR THERMATRIX SAMPLING EVENTS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-2	2/3/97, 1305															Opened VEW/VW-2
VEW/VW-2		2/3/97	1507	NA	2.03	114	82.4	17.6	100	170	17.5	3.7	140	18.7	2.5	Sample Collected
VEW/VW-2		2/4/97	1301	21.90	24.00	109	80.4	19.6	100	230	18	3.5	185	19.3	2.3	Sample Collected
VEW/VW-2	2/4/97, 1325															Closed VEW/VW-2
VEW/VW-11	2/5/97, 1350															Opened VEW/VW-11
VEW/VW-11		2/5/97	1452	NA	1.03	109	75.0	25.0	100	160	19.7	2	120	20.3	1.3	Sample Collected
VEW/VW-11		2/7/97	1117	44.40	45.43	110	75.0	25.0	100	160	20.2	1.7	120	20.7	0.8	Sample Collected
VEW/VW-11	2/7/97, 1148															Closed VEW/VW-11
VEW/VW-6&14	2/7/97, 1204															Opened VEW/VW-6&14
VEW/VW-6&14		2/7/97	1310	NA	1.10	110	63.3	36.7	100	1500	6.7	10.8	950	14.7	5.7	Sample Collected
VEW/VW-6&14		2/19/97	0906	283.90	285.00	130	75.4	24.6	100	3050	9.9	7.8	2300	13.8	5.7	Sample Collected
VEW/VW-6&14		2/21/97	1200	61.10	337.10	113	63.5	36.5	100	2600	11	7.2	1650	15.8	4.2	Sample Collected
VEW/VW-6&14		2/24/97	0839	68.70	405.80	106	63.9	36.1	100	1800	11.1	7.2	1150	17	3.7	Sample Collected
VEW/VW-6&14		3/5/97	1630	224.20	630.00	112	60.0	40.0	100	3500	12	6.5	2100	17.1	3.1	Sample Collected, QA,QC samples collected
VEW/VW-6&14		3/6/97	1030	18.00	648.00	106	66.7	33.3	100	3900	11.8	6.5	2600	15.8	4	Sample Collected
VEW/VW-6&14	3/6/97, 1245															Closed VEW/VW-14
VEW/VW-6	3/6/97,1300															Operating exclusively on VEW/VW-6
VEW/VW-6		3/11/97	1530	NA	122.50	118	66.7	33.3	100	4200	14	5.5	2800	16.8	3.3	Sample Collected
VEW/VW-6	3/12/97, 1521															System Shutdown. Sample pump shorted out system.
VEW/VW-6	3/14/97, 2347															System Restart, Operating on VEW/VW-6
VEW/VW-6		3/18/97	1625	112.50	235.00	146	89.7	10.3	100	3900	15.2	4.5	3500	16	4	Sample Collected
VEW/VW-6	3/18/97, 1700															Closed VEW/VW-6
VEW/VW-14	3/18/97, 1715															Opened VEW/VW-14
VEW/VW-14		3/19/97	1645	NA	23.50	150	62.5	37.5	100	640	15.9	4	400	18	2.1	Sample Collected
VEW/VW-14		3/20/97	1720	24.40	47.90	148	74.6	25.4	100	590	13.8	4.1	440	16.9	2.6	Sample Collected
VEW/VW-14		3/25/97	1337	116.30	164.20	140	78.7	21.3	100	375	16.7	3.9	295	18.3	2.6	Sample Collected
VEW/VW-14	3/25/97, 1420															Closed VEW/VW-14, Final System Shutdown

TABLE 3
HYDROCARBON MASS REMOVAL AND EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[c]	Influent THC[a] Concentration (µg/L)[d]	Flow Rate (scfm)	Effluent THC Concentration[b] (ppmv)	Effluent THC Concentration[b] (µg/L)	Pounds of THC Removed	Total Daily THC Emissions[b] (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23	96	100	32	133	0	1.19
12/9/96	VEW/VW-7	3.13	68	283	100	NA[e]	NA	8	-[f]
12/9/96	VEW/VW-14	0.06	120	499	100	NA	NA	0	-
12/13/96	VEW/VW-14	3.96	200	831	100	4	15	30	0.14
12/18/96	VEW/VW-8	4.98	690	2,868	100	NA	NA	128	-
12/24/96	VEW/VW-8	0.04	690	2,868	100	9	38	1	0.34
12/27/96	VEW/VW-8	3.23	530	2,203	100	12	50	64	0.45
12/27/96	VEW/VW-9	0.02	20	83	100	NA	NA	0	-
1/3/97	VEW/VW-9	6.83	18	75	100	4	18	5	0.16
1/3/97	VEW/VW-12	0.19	180	748	100	5	21	1	0.19
1/7/97	VEW/VW-12	3.66	580	2,411	100	NA	NA	79	-
1/7/97	VEW/VW-13	0.04	490	2,037	100	26	108	1	0.97
1/14/97	VEW/VW-13	6.75	180	748	100	NA	NA	45	-
1/14/97	VEW/VW-10	0.20	550	2,286	100	NA	NA	4	-
1/22/97	VEW/VW-3	4.42	1,200	4,989	100	24	100	198	0.89
1/27/97	VEW/VW-4	0.08	ND	ND	100	ND	ND	0	-
2/3/97	VEW/VW-4	12.67	870	3,617	100	NA	NA	411	-
2/3/97	VEW/VW-2	0.08	12	50	100	3	13	0.04	0.12
2/4/97	VEW/VW-2	0.92	13	54	100	NA	NA	0.4	-
2/4/97	VEW/VW-11	0.08	25	104	100	4	17	0.1	0.16
2/7/97	VEW/VW-11	2.84	24	100	100	NA	NA	3	-
2/7/97	VEW/VW-6 and -14	0.40	1,500	6,236	100	32	133	22	1.19
2/19/97	VEW/VW-6 and -14	11.92	3,700	15,381	100	88	366	1,644	3.28
2/21/97	VEW/VW-6 and -14	1.88	3,800	15,797	100	140	582	266	5.22
2/24/97	VEW/VW-6 and -14	2.85	4,200	17,460	100	220	915	446	8.20
3/5/97	VEW/VW-6 and -14	9.34	1,500	6,236	100	0	0	522	0.00
3/6/97	VEW/VW-6 and -14	0.75	1,700	7,067	100	0.9	4	48	0.03
3/11/97	VEW/VW-6	0.10	2,300	9,561	100	1.4	6	9	0.05
3/18/97	VEW/VW-6	3.69	2,600	10,809	100	0	0	358	0.00
3/19/97	VEW/VW-14	0.98	170	707	100	0.2	1	6	0.01
3/20/97	VEW/VW-14	1.02	83	345	100	0	0	3	0.00
3/25/97	VEW/VW-14	4.85	98	407	100	0	0	18	0.00
							Total =	8,221	

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] Effluent sample results from samples collected from 9/2/96 through 2/24/97 may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the sample.
procedures that may have caused cross-contamination of the sample (see Attachment 1).

[c] ppmv = parts per million by volume, as determined by the analytical laboratory.

[d] µg/L = micrograms per liter, as determined by the analytical laboratory.

[e] NA = not analyzed.

[f] Effluent samples not collected during sampling event.

Fil 728414.04000
Job Files
Analytical Data Reports.

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc: P. Guest.
M. Vessely.
D. Downey.
R. Martin (Thermatrix via fax)
done.

March 20, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 6, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2, 3, and 4, which constitute Analytical Data Report No. 6 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of February 1997, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO unit operated for the entire month of February. Please note that effluent sample results may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the samples. Parsons ES and Thermatrix have developed revised sampling procedures that are being implemented for all SUMMA® canister vapor samples collected in March. The results for these samples will be presented in the next analytical data report. The February 1997 data represent the following FTO treatment unit operating conditions:

- On February 3, 1997, Parsons ES collected an influent SUMMA® canister vapor sample from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-4 during sample collection. Photoionization detector (PID) readings increased from a volatile organic compound (VOC) concentration of 570 parts per million by volume (ppmv) on January 27, 1997, to 1,200 ppmv at the time of sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-2. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 2 hours of vapor extraction from well VE/VW-2.

- On February 4, 1997, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-2 during sample collection. Well VE/VW-2 PID readings increased from a VOC concentration of 170 ppmv on February 3, 1997, to 230 ppmv at the time of sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-11. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 2 hours of vapor extraction from well VE/VW-11.

- On February 5, 1997, Parsons ES collected SUMMA® canister samples from well VE/VW-1, VE/VW-3, and MW-108 following approximately 4 hours of purging with a 10-standard-cubic-foot-per-minute (scfm) pump. The analytical results for the sample from well VE/VW-3 will be used to verify the accuracy of the analytical results for the first sample collected from well VE/VW-3, in which no specific VOCs were detected above the method detection limit, although total volatile hydrocarbons (TVH) were reported at 1,000 ppmv.

- On February 7, 1997, the FTO treatment unit was connected to and began treating and extracting vapors from wells VE/VW-6 and VE/VW-14. These two wells were selected for combined extraction because well VE/VW-6 had the highest detected TVH concentration (6,000 ppmv), and the lowest oxygen concentration (0 percent initially), and well VE/VW-14 had the highest TCE concentrations (120 ppmv initially, and 71 ppmv after 93 hours of FTO operation).

- On February 19, 1997, Parsons ES collected influent and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during sample collection. PID readings increased from a VOC concentration of 1,500 ppmv on February 7, 1997, to 3,050 ppmv at the time of sample collection.

- On February 21, 1997, Parsons ES collected influent and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during sample collection. PID readings decreased from a VOC concentration of 3,050 ppmv on February 19, 1997, to 2,600 ppmv at the time of sample collection.

- On February 24, 1997, Parsons ES collected influent and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during sample collection. PID readings decreased from a VOC concentration of 2,600 ppmv on February 21, 1997, to 1,800 ppmv at the time of sample collection.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Mark Vessely
for
Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Chuck Wright, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
FEBRUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a]						
Analyte	Influent Sample FT002VW4I2 2/3/97	Influent Sample FT002VW2I1A 2/3/97	Effluent Sample[b] FT002VW2E1A 2/3/97	Influent Sample FT002VW2I2 2/4/97	Influent Sample FT002VW11I1A 2/4/97	Effluent Sample[b] FT002VW11E1A 2/4/97	Influent Sample FT002VW11I2A 2/7/97
1,1-Dichloroethene	ND[c]	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	1500	350	160	230	140	70	200
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	780	150	62	110	68	31	100
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
2-Butanone (Methyl Ethyl Ketone)	ND	ND	ND	ND	ND	ND	ND
4-Bromofluorobenzene	102	103	99	NA	NA[d]	NA	102
4-Ethyltoluene	1300	180	74	130	ND	35	120
Acetone	ND	ND	15	ND	ND	ND	ND
Benzene	320	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	170	36	4	41	370	4	490
Ethyl Benzene	1500	39	16	18	ND	ND	ND
Freon 113	ND	19	ND	20	1100	ND	510
Heptane	31000	58	18	28	ND	ND	ND
Hexane	14000	ND	ND	ND	ND	ND	ND
m,p-Xylene	6100	290	130	220	110	56	170
Methylene Chloride	150	11	16	ND	ND	ND	ND
o-Xylene	1600	170	80	190	90	55	160
Octafluorotoluene	104	102	108	NA	NA	NA	104
Tetrachloroethene	ND	14	ND	11	1700	45	810
Tetrahydrofuran	ND	ND	ND	ND	350	ND	ND
THC[e]	870000	12000	3100	13000	25000	4200	24000
Toluene	380	28	15	58	ND	12	33
Toluene-d8	102	99	100	NA	NA	NA	99
Trichloroethene	110	1400	35	1200	13000	180	7100

TABLE 1 (concluded)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
FEBRUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a]							
Analyte	Influent Sample FT002VW6&14I 2/7/97	Effluent Sample[b] FT002VW6&14E1 2/7/97	Influent Sample FT002VW6&14I2 2/19/97	Effluent Sample[b] FT002VW6&14E2 2/19/97	Influent Sample FT002VW6&14I3 2/21/97	Effluent Sample[b] FT002VW6&14E3 2/21/97	Influent Sample FT002VW6&14I4 2/24/97	Effluent Sample[b] FT002VW6&14E4 2/24/97
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	1000	290	6600	2300	9900	5100	4500	4200
1,2-Dichlorobenzene	ND	16	ND	53	ND	71	ND	38
1,3,5-Trimethylbenzene	1400	310	5600	1200	7200	2800	4000	2700
1,3-Dichlorobenzene	ND	4	ND	8	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	9	ND	20	ND	31	ND	ND
2-Butanone (Methyl Ethyl Ketone)	ND	54	ND	ND	ND	ND	ND	ND
4-Bromofluorobenzene	101	113	NA	NA	ND	ND	ND	ND
4-Ethyltoluene	1000	190	6100	1300	9400	3300	5900	3600
Acetone	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	3200	36	10000	140	8100	170	9100	200
cis-1,2-Dichloroethene	66000	700	190000	2200	140000	2600	160000	2800
Ethyl Benzene	ND	13	1300	94	1400	210	1400	250
Freon 113	340	ND	ND	ND	ND	ND	ND	ND
Heptane	35000	150	180000	930	130000	1400	140000	2400
Hexane	47000	62	170000	290	120000	390	120000	630
m,p-Xylene	7000	590	34000	2900	48000	7800	43000	9600
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	7000	750	21000	2500	28000	5600	23000	6500
Octafluorotoluene	103	107	NA	NA	ND	ND	ND	ND
Tetrachloroethene	ND	7	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	47	ND	ND	ND	ND	ND	ND
THC	1500000	32000	3700000	88000	3800000	140000	4200000	220000
Toluene	11000	370	49000	1700	42000	2700	48000	3200
Toluene-d8	106	102	NA	NA	ND	ND	ND	ND
Trichloroethene	35000	650	18000	360	28000	840	19000	610

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See Table 3 for field measurements and system operating conditions at the time of sampling.

[b] Effluent sample results may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the sample.

[c] ND = Not detected.

[d] NA = Not available.

[e] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 2

DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES FROM VENT WELLS[a]

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	FT002VW111 Detected Concentration 2/17/97 (ppbv)[b]	FT002VW211 Detected Concentration 2/17/97 (ppbv)	FT002VW311 Detected Concentration 2/17/97 (ppbv)	FT002VW411 Detected Concentration 2/17/97 (ppbv)	FT002VW1111 Detected Concentration 2/17/97 (ppbv)	FT002-MW108-11 Detected Concentration 2/5/97 (ppbv)	FT-002MW108-11 Duplicate Detected Concentration 2/5/97 (ppbv)	FT002-VW1-12 Detected Concentration 2/5/97 (ppbv)	FT002-VW3-IX Detected Concentration 2/5/97 (ppbv)
1,1-Dichlorobenzene	ND[c]	ND	ND	ND	ND	1800	1900	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	24000	21000	220	1300
1,3,5-Trimethylbenzene	ND	ND	ND	ND	ND	11000	10000	98	800
4-Bromoflorobenzene	ND	ND	ND	ND	ND	97	99	100	104
4-Ethyltoluene	ND	ND	ND	ND	ND	20000	19000	96	ND
Benzene	ND	ND	ND	ND	ND	28000	28000	ND	ND
cis-1,2-Dichloroethene	ND	38	ND	ND	330	460000	460000	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	25000	25000	20	340
Freon 113	ND	14	ND	ND	1200	ND	ND	ND	ND
Heptane	ND	ND	ND	4500	ND	140000	140000	38	36000
Hexane	ND	ND	ND	1300	ND	210000	200000	19	8000
m,p-Xylene	ND	ND	ND	170	ND	140000	140000	160	1800
Methylene Chloride	ND	ND	ND	ND	ND	2000	1100	4	390
o-Xylene	ND	ND	ND	ND	ND	48000	48000	160	900
Octafluorotoluene	ND	ND	ND	ND	ND	97	99	100	104
Tetrachloroethene	67	14	ND	ND	1500	ND	ND	69	ND
Tetrahydrofuran	130	140	ND	ND	560	ND	ND	ND	ND
THC[d]	400	2000	1100000	210000	21000	6800000	6400000	5100	2300000
Toluene	ND	ND	ND	ND	ND	140000	140000	39	ND
Toluene -d8	NA[e]	NA	NA	NA	NA	102	102	99	103
Trichloroethene	ND	1700	ND	ND	13000	300000	300000	7	ND

[a] SUMMA canister samples collected following approximately 2 hours of purging with a 10-scfm pump.

[b] ppbv = parts per billon volume, as determined by Air Toxics, Folsum, CA using USEPA Method TO-14 GC/MS Full Scan.

[c] ND = Not detected.

[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

[e] NA = Not analyzed.

TABLE 3
FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	VOCs Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	VOCs After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage

TABLE 3 (Continued)
FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	VOCs Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	VOCs After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	93.08											Closed VEW/VW-12
VEW/VW-13	1/7/97, 1505															Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	NA	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	162.00											Closed VEW/VW-13
VEW/VW-10	1/14/97, 1020															Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	NA	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	82.17											System shutdown due to weather-related low propane pressure.
-	1/21/97, 1515															System operational. TIC-315 control setpoint changed to 1200deg F
	1/22/97, 0400															System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634															System operational
VEW/VW-3	1/22/97, 1708															Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	NA	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300															System shutdown due to weather-related low propane pressure.
	1/27/97, 1600															System operational
	1/27/97, 1825															Opened VEW/VW-4
VEW/VW-4		1/27/97	2030	NA	2.10	94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected
VEW/VW-4		2/3/97	1225	139.90	114.00	47.9	52.1	52.1	100	1200	7.7	8.7	575	14.5	4.7	Sample collected
VEW/VW-4	2/3/97															Closed VEW/VW-4
VEW/VW-2	2/3/97 1305															Opened VEW/VW-2
VEW/VW-2		2/397	1509	NA	2.00	114	82.4	17.6	100	170	17.5	3.7	140	18.7	2.5	Sample collected

TABLE 3 (Continued)
FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	VOCs Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	VOCs After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-2		2/4/97	1304	21.90	24.00	109	80.4	19.6	100	230	18	3.5	185	19.3	2.5	Sample collected
VEW/VW-2	2/4/97 1325															Closed VEW/VW-2
VEW/VW-11	2/4/97 1350															Opened VEW/VW-11
VEW/VW-11		2/4/97	1457	NA	1.08	109	75.0	25.0	100	160	19.7	2	120	20.3	1.3	Sample collected
VEW/VW-11		2/7/97	1117	44.40	45.43	110	75.0	25.0	100	160	20.2	1.7	120	20.7	0.8	Sample collected
VEW/VW-11	2/7/97 1148															Closed VEW/VW-11
VEW/VW-6&-14	2/7/1997 1204															Opened VEW/VW-6&14
VEW/VW-6&-14		2/7/97	1310	NA	1.10	110	63.3	36.7	100	1500	6.7	10.8	950	14.7	5.7	Sample collected
VEW/VW-6&-14		2/19/97	906	283.90	285.00	130	75.4	24.6	100	3050	9.9	7.8	2300	13.8	5.7	Sample collected
VEW/VW-6&-14		2/21/97	1200	61.10	337.10	112	63.5	36.5	100	2600	11	7.2	16.5	15.8	4.2	Sample collected
VEW/VW-6&-14		2/24/97	839	68.70	405.80	106	63.9	36.1	100	1800	11.1	7.2	1150	17	3.7	Sample collected, QA/QC sample collected
VEW/VW-6&-14		3/5/97	1630	224.20	630.00	112	70.0	30.0	100	3500	12	6.5	2100	17.1	3.1	Sample collected
VEW/VW-6&-14		3/6/97	1030	18.00	648.00	106	66.7	33.3	100	3900	11.8	6.5	2600	15.8	4	Sample collected
VEW/VW-6&-14	3/6/1997 1245															Closed VEW/EW-14
VEW/VW-6	3/6/97 1300															Operating on VEW/VW-6 exclusively
VEW/VW-6	3/11/97	3/11/97	1530	NA	122.50	118	70.0	30.0	100	4200	14	5.5	2800	16.8	3.3	Sample Collected
VEW/VW-6	3/12/97		1521													System shutdown, sample pump shorted out the unit.
VEW/VW-6	3/14/97															System online and on VEW/VW-6

TABLE 4
HYDROCARBON REMOVAL AND EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[c]	Influent THC[a] Concentration (μg/L)[d]	Flow Rate (scfm)	Effluent THC Concentration[b] (ppmv)	Effluent THC Concentration[b] (μg/L)	Pounds of THC Removed	Total Daily THC Emissions[b] (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23	96	100	32	133	0	1.19
12/9/96	VEW/VW-7	3.13	68	283	100	NA[e]	NA	8	-[f]
12/9/96	VEW/VW-14	0.06	120	499	100	NA	NA	0	-
12/13/96	VEW/VW-14	3.96	200	831	100	4	15	30	0.14
12/18/96	VEW/VW-8	4.98	690	2,868	100	NA	NA	128	-
12/24/96	VEW/VW-8	0.04	690	2,868	100	9	38	1	0.34
12/27/96	VEW/VW-8	3.23	530	2,203	100	12	50	64	0.45
12/27/96	VEW/VW-9	0.02	20	83	100	NA	NA	0	-
1/3/97	VEW/VW-9	6.83	18	75	100	4	18	5	0.16
1/3/97	VEW/VW-12	0.19	180	748	100	5	21	1	0.19
1/7/97	VEW/VW-12	3.66	580	2,411	100	NA	NA	79	-
1/7/97	VEW/VW-13	0.04	490	2,037	100	26	108	1	0.97
1/14/97	VEW/VW-13	6.75	180	748	100	NA	NA	45	-
1/14/97	VEW/VW-10	0.20	550	2,286	100	NA	NA	4	-
1/22/97	VEW/VW-3	4.42	1,200	4,989	100	24	100	198	0.89
1/27/97	VEW/VW-4	0.08	ND	ND	100	ND	ND	0	-
2/3/97	VEW/VW-4	12.67	870	3,617	100	NA	NA	411	-
2/3/97	VEW/VW-2	0.08	12	50	100	3	13	0.04	0.12
2/4/97	VEW/VW-2	0.92	13	54	100	NA	NA	0.4	-
2/4/97	VEW/VW-11	0.08	25	104	100	4	17	0.1	0.16
2/7/97	VEW/VW-11	2.84	24	100	100	NA	NA	3	-
2/7/97	VEW/VW-6 and -14	0.40	1,500	6,236	100	32	133	22	1.19
2/19/97	VEW/VW-6 and -14	11.92	3,700	15,381	100	88	366	1,644	3.28
2/21/97	VEW/VW-6 and -14	1.88	3,800	15,797	100	140	582	266	5.22
2/24/97	VEW/VW-6 and -14	2.85	4,200	17,460	100	220	915	446	8.20

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] Effluent sample results may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the sample.

[c] ppmv = parts per million by volume, as determined by the analytical laboratory.

[d] μg/L = micrograms per liter, as determined by the analytical laboratory.

[e] NA = not analyzed.

[f] Effluent samples not collected during sampling event.

File: 728414.04
Job Files
Analytical Data Rpt

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax (303) 831-8208

cc: P Guest
M. Vessely
D. Downey (FYI)

February 20, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 5, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2, 3, and 4, which constitute Analytical Data Report No. 5 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of January 1997, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO unit operated 25.7 days during the month of January. The January 1997 data represent the following FTO treatment unit operating conditions:

- On January 3, 1997, Engler Electric heat traced the piping from the FTO treatment unit to the soil vapor extraction (SVE) building at Site FT-002.

- On January 3, 1997, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-9 during the sample collection. Photoionization detector (PID) readings for influent vapors decreased from a concentration of 135 parts per million by volume (ppmv) on December 27, 1996, to 40 ppmv at the time of sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-12. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 4 hours of vapor extraction from well VE/VW-12.

- On January 7, 1997, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-12 during the sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-13. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 1 hour of extracting vapors from well VE/VW-13.

- On January 14, 1997, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-13 during the sample collection. The influent vapor PID readings remained at a concentration of 930 ppmv during this time period. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-10. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 2 hours of extracting vapors from well VE/VW-10. The PID reading was approximately 700 to 800 ppmv at the time of sample collection.

- On January 17, 1997, Parsons ES collected SUMMA® canister samples from wells VE/VW-1, VE/VW-2, VE/VW-3, and VE/VW-4 following approximately 2 hours of purging with a 10-standard-cubic-foot-per-minute (scfm) pump. The results of these samples will be used to determine the concentrations of individual compounds and total volatile hydrocarbons (TVH) so that the future operating parameters of the FTO treatment unit can be determined.

- On January 18, 1997, at approximately 9:40 p.m., Mr. Dave Brown (Parson ES Syracuse) received a telephone call from Security Concepts (subcontractor that installed the alarm system on the FTO treatment unit) informing him that the FTO treatment unit had stopped operating. The shutdown was due to a low pressure reading that probably was caused by very cold ambient temperatures (minus 27 degrees Fahrenheit). At low ambient temperatures, the pressure from the propane tank is reduced, resulting in a low-pressure shutdown of the FTO treatment unit.

- On January 21, 1997, Mr. John Mackey traveled to Plattsburgh AFB to assess the cause of the shutdown and to restart the FTO treatment unit. The unit was restarted at approximately 9:35 a.m., and was connected to and began treating vapors from well VE/VW-3.

- On January 22, 1997, at approximately 4:00 a.m., Mr. Dave Brown received a telephone call from Security Concepts informing him that the FTO treatment unit had again stopped operating. The shutdown was due to a Base-wide power outage caused by an ice storm.

- On January 22, 1997, Mr. John Mackey traveled to Plattsburgh AFB to restart the FTO treatment unit. The unit was restarted at approximately 11:35 a.m., and was connected to and resumed treating vapors from well VE/VW-3. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 8 hours of extracting vapors from well VE/VW-3.

- On January 27, 1997, at approximately 3:00 a.m., Mr. Dave Brown received a telephone call from Security Concepts informing him that the FTO treatment unit had stopped operating. On this date, Mr. John Mackey traveled to Plattsburgh AFB to restart the FTO treatment unit. The unit was restarted at approximately 11:30 a.m., and was connected to and began treating vapors from well VE/VW-4.

An influent and effluent SUMMA® canister vapor sample were collected from the FTO treatment unit following approximately 2.5 hours of extracting vapors from well VE/VW-4. The PID reading from the well was 570 ppmv. Mr. Mackey also increased the flow rate of supplemental fuel from the propane tank, which should alleviate the problem of shutdowns associated with low-pressure readings.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
JANUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a]			Detected Concentration (ppbv)				Detected Concentration (ppbv)		
Analyte	Influent Sample FT002VW9I2 1/3/97	Effluent Sample FT002VW9E1 1/3/97	Destruction Efficiency (percent)	Influent Sample FT002VW12I1 1/3/97	Effluent Sample FT002VW12E1 1/3/97	Destruction Efficiency (percent)	Influent Sample FT002VW12I2 1/7/97	Influent Sample FT002VW13I1 1/7/97	Effluent Sample FT002VW13E1 1/7/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	440	250	43.2	210	150	28.6	2400	240	220	8.3
1,2-Dichlorobenzene	ND[b]	4	NA[c]	ND	ND	NA	ND	ND	ND	NA
1,3,5-Trimethylbenzene	320	100	68.8	200	64	68.0	1600	ND	91	NA
4-Ethyltoluene	240	68	71.7	ND	37	NA	1200	ND	120	NA
Benzene	15	ND	100.0	310	ND	100.0	1200	820	9.8	98.8
Chloromethane	ND	ND	NA	ND	ND	NA	ND	ND	ND	NA
cis-1,2-Dichloroethene	ND	3	NA	7700	70	99.1	16000	81000	830	99.0
cis-1,3-Dichloropropene	230	ND	100.0	ND	ND	NA	ND	ND	ND	NA
Ethyl Benzene	59	6	89.8	ND	12	NA	930	ND	20	NA
Freon 113	ND	ND	NA	ND	ND	NA	ND	1500	ND	100.0
Heptane	220	ND	100.0	4100	23	99.4	18000	3300	46	98.6
Hexane	120	ND	100.0	3900	ND	100.0	15000	2600	ND	100.0
m,p-Xylene	1200	130	89.2	440	94	78.6	6200	340	140	58.8
Methylene Chloride	ND	ND	NA	ND	ND	NA	280	ND	ND	NA
o-Xylene	860	110	87.2	280	81	71.1	4300	360	160	55.6
Tetrachloroethene	17	12	29.4	ND	ND	NA	ND	520	38	92.7
Tetrahydrofuran	ND	ND	NA	ND	ND	NA	ND	ND	ND	NA
Toluene	310	25	91.9	720	42	94.2	6400	2000	120	94.0
Trichloroethene	330	34	89.7	26000	430	98.3	33000	24000	550	97.7
THC[d]	18000	4400	75.6	180000	5100	97.2	580000	490000	26000	94.7

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TABLE 1 (concluded)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
JANUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

			Detected Concentration (ppbv)			Detected Concentration (ppbv)		
Analyte	Influent Sample FT002VW13I2 1/14/97	Influent Sample FT002VW10I1A 1/14/97	Influent Sample FT002VW3I1 1/22/97	Effluent Sample FT002VW3E1 1/22/97	Destruction Efficiency (percent)	Influent Sample FT002VW4I1 1/27/97	Effluent Sample FT002VW4E1 1/27/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	280	750	420	280	33.3	420	250	40.5
1,2-Dichlorobenzene	ND	ND	ND	5	NA	ND	ND	NA
1,3,5-Trimethylbenzene	190	570	260	140	46.2	190	99	47.9
4-Ethyltoluene	270	690	ND	150	NA	220	110	50.0
Benzene	270	560	230	6	97.4	34	ND	100.0
Chloromethane	ND	79	ND	ND	NA	ND	ND	NA
cis-1,2-Dichloroethene	9300	5100	ND	16	NA	ND	ND	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	NA	ND	ND	NA
Ethyl Benzene	470	300	ND	32	NA	120	19	84.2
Freon 113	180	490	ND	ND	NA	ND	ND	NA
Heptane	4700	2400	11000	200	98.2	5900 E[d/]	57	99.0
Hexane	2800	5900	4000	26	99.4	1800	ND	100.0
m,p-Xylene	1600	1200	340	220	35.3	450	100	77.8
Methylene Chloride	ND	ND	ND	ND	NA	21 B[e/]	11 B	47.6
o-Xylene	760	1100	290	190	34.5	150	56	62.7
Tetrachloroethene	300	2200	ND	12	NA	ND	ND	NA
Tetrahydrofuran	ND	ND	ND	ND	NA	ND	ND	NA
Toluene	2600	960	ND	60	NA	37	9	75.7
Trichloroethene	6500	21000	ND	67	NA	43	9.6	77.7
THC[f/]	180000	550000	1200000	24000	98.0	ND	ND	NA

a/ ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See table 2 for field measurements and system operating conditions at the time of sampling.
b/ ND = Not detected.
c/ NA = Not available.
d/ E = value exceeds instrument calibration range, but is within linear range.
e/ B = compound present in laboratory blank and a background substraction was not performed.
f/ THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

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TABLE 2
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES FROM
VENT WELLS VW-1, VW-2, VW-3, VW-4, AND VW-11[a]
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	FT002VW1I1 Detected Concentration (ppbv)[b]	FT002VW2I1 Detected Concentration (ppbv)	FT002VW3I1 Detected Concentration (ppbv)	FT002VW4I1 Detected Concentration (ppbv)	FT002VW11I1 Detected Concentration (ppbv)
cis-1,2-Dichloroethene	ND[c]	38	ND	ND	330
Freon 113	ND	14	ND	ND	1200
Heptane	ND	ND	ND	4500	ND
Hexane	ND	ND	ND	1300	ND
m,p-Xylene	ND	ND	ND	170	ND
Tetrachloroethene	67	14	ND	ND	1500
Tetrahydrofuran	130	140	ND	ND	560
Trichloroethene	ND	1700	ND	ND	13000
THC[d]	400	2000	1100000	210000	21000

[a] SUMMA canister samples collected on January 17, 1997, following approximately 2 hours of purging with a 10-scfm pump.

[b] ppbv = parts per billon volume, as determined by Air Toxics, Folsum, CA using USEPA Method TO-14 GC/MS Full Scan.

[c] ND = Not detected.

[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 3

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage

TABLE 3

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25		.									Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	93.08											Closed VEW/VW-12
VEW/VW-13	1/7/97, 1505															Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	NA	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	162.00											Closed VEW/VW-13
VEW/VW-10	1/14/97, 1020															Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	NA	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	82.17											System shutdown due to weather-related low propane pressure.
-	1/21/97, 1515															System operational, TIC-313 control setpoint changed to 1200deg F
	1/22/97, 0400															System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634															System operational
VEW/VW-3	1/22/97, 1708															Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	NA	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300															System shutdown due to weather-related low propane pressure.
	1/27/97, 1600															System operational
	1/27/97, 1825															Opened VEW/VW-4
VEW/VW-4		1/27/97	2030			94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected

TABLE 4
HYDROCARBON EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[b]	Influent THC[a] Concentration (μg/L)[c]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (μg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23	96	100	32	133	0	1.19
12/9/96	VEW/VW-7	3.13	68	283	100	NA[d]	NA	8	-[e]
12/9/96	VEW/VW-14	0.06	120	499	100	NA	NA	0	-
12/13/96	VEW/VW-14	3.96	200	831	100	4	15	30	0.14
12/18/96	VEW/VW-8	4.98	690	2,868	100	NA	NA	128	-
12/24/96	VEW/VW-8	0.04	690	2,868	100	9	38	1	0.34
12/27/96	VEW/VW-8	3.23	530	2,203	100	12	50	64	0.45
12/27/96	VEW/VW-9	0.02	20	83	100	NA	NA	0	-
1/3/97	VEW/VW-9	6.83	18	75	100	4	18	5	0.16
1/3/97	VEW/VW-12	0.19	180	748	100	5	21	1	0.19
1/7/97	VEW/VW-12	3.66	580	2,411	100	NA	NA	79	-
1/7/97	VEW/VW-13	0.04	490	2,037	100	26	108	1	0.97
1/14/97	VEW/VW-13	6.75	180	748	100	NA	NA	45	-
1/14/97	VEW/VW-10	0.20	550	2,286	100	NA	NA	4	-
1/22/97	VEW/VW-3	4.42	1,200	4,989	100	24	100	198	0.89
1/27/97	VEW/VW-4	0.08	ND	ND	100	ND	ND	0	-

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] ppmv = parts per million by volume, as determined by the analytical laboratory.

[c] μg/L = micrograms per liter, as determined by the analytical laboratory.

[d] NA = not analyzed.

[e] Effluent samples not collected during sampling event.

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File: 728414.04000
Job Files
Analytical Data Rpt.
cc: P. Guest
M. Vessely
D. Downey (FYI)

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax. (303) 831-8208

January 23, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 4, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2 and 3, which constitute Analytical Data Report No. 4 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of December 1996, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The December 1996 data represent the following FTO treatment unit operating conditions:

- On December 4 and 5, 1996, a new variable frequency drive (VFD) was installed, and the FTO unit was placed in the pre-heat mode. The FTO unit was down from November 4, 1996 at 1:24 p.m. through December 6, 1996 at 8:45 a.m.

- On December 6, 1996, the FTO treatment unit was connected to and began treating vapors from well VE/VW-7. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 1.5 hours of extracting vapors from well VE/VW-7.

- On December 9, 1996, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-7 during the sample collection. The photoionization detector (PID) reading increased from a concentration of 26 parts per million by volume (ppmv) to 260 ppmv during this time period, and the oxygen concentration decreased from 18 percent to 15. 9 percent. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-14. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 1.5 hours of extracting vapors from well VE/VW-14.

- On December 13, 1996, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collections. Between December 9 and December 13, 1996, the PID reading increased slightly from 320 ppmv to 420 ppmv, and the oxygen concentration increased from 11 percent to 16 percent. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW -8.

- On December 16, 1996, the FTO treatment unit was shut down while an electrical subcontractor (Engler Electric) reconfigured the electrical connections of the FTO unit to enable the blower to be operated with or without the VFD.

- On December 17, 1996, the electrical reconfiguration was completed, the unit was placed in the pre-heat mode, and at 3:30 p.m. the FTO treatment unit was re-connected to and continued treating vapors from well VE/VW-8. The FTO treatment unit was down for 23 hours and 18 minutes.

- On December 18, 1996, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-8 during the time of sample collection. The PID reading was 580 ppmv, and the oxygen concentration was 13.5 percent at the time of sample collection.

- On December 24, 1996, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-8 during the sample collections. The PID reading increased to a concentration of 970 ppmv during this time period. An oxygen concentration measurement was not obtained because the O_2/CO_2 meter was not functioning properly.

- On December 27, 1996, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-8 during the sample collections. The PID reading decreased slightly to a concentration of 850 ppmv during this time period. An oxygen concentration measurement was not obtained because the O_2/CO_2 meter was not functioning properly. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-9. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 0.5 hour of extracting vapors from well VE/VW-9.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables have been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1

DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES

DECEMBER 1996

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv)[a]		Destruction Efficiency (percent)	Detected Concentration				Destruction Efficiency (percent)
	Influent Sample FT002VW7I1	Effluent Sample FT002VW7E1[b]		Influent Sample FT002VW7I2	Influent Sample FT002VW14I1	Influent Sample FT002VW14I2	Effluent Sample FT002VW14E1	
1,2,4-Trimethylbenzene	320	780	-143.8	960	650	850	180	78.8
1,2-Dichlorobenzene	ND[c]	16	NA[d]	ND	ND	ND	4	NA
1,3,5-Trimethylbenzene	150	350	-133.3	420	ND	640	85	86.7
cis-1,2-Dichloroethene	1300	ND	100.0	2100	980	2500	14	99.4
cis-1,3-Dichloropropene	ND	77	NA	ND	ND	ND	ND	NA
m,p-Xylene	400	640	-60.0	1100	ND	2800	200	92.9
4-Ethyltoluene	ND	390	NA	ND	ND	650	77	88.2
Benzene	ND	11	NA	ND	ND	ND	ND	NA
Ethyl Benzene	ND	27	NA	ND	ND	270	19	93.0
Freon 113	99	ND	100.0	920	3300	840	ND	100.0
Heptane	ND	65	NA	ND	ND	4300	36	99.2
Hexane	ND	ND	NA	ND	ND	ND	ND	NA
o-Xylene	270	530	-96.3	840	500	1700	170	90.0
Propylene	ND	ND	NA	ND	ND	ND	ND	NA
Styrene	ND	ND	NA	ND	ND	ND	46	NA
Tetrachloroethene	2800	550	80.4	2900	370	440	10	97.7
Toluene	160	160	0.0	330	ND	1100	59	94.6
Trichloroethene	16000	1400	91.3	35000	120000	71000	420	99.4
THC[e]	23000	32000	-39.1	68000	120000	200000	3700	98.2

TABLE 1 (concluded)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
DECEMBER 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Influent Sample FT002VW8I1	Influent Sample FT002VW8I2	Influent Sample FT002VW8I2 D	Effluent Sample FT002VW8E1	Destruction Efficiency (percent)	Detected Concentration Influent Sample FT002VW8I3	Detected Concentration Effluent Sample FT002VW8E2	Destruction Efficiency (percent)	Detected Concentration Influent Sample FT002VW9I1
1,2,4-Trimethylbenzene	640	560	640	260	59.4	410	380	7.3	420
1,2-Dichlorobenzene	ND	ND	ND	4	NA	ND	5	NA	4
1,3,5-Trimethylbenzene	450	490	540	120	77.8	460	170	63.0	250
cis-1,2-Dichloroethene	2300	4100	4200	15	99.6	4200	34	99.2	460
cis-1,3-Dichloropropene	ND	ND	ND	ND	NA	ND	ND	NA	ND
m,p-Xylene	1100	3600	3800	280	92.6	2000	280	86.0	730
4-Ethyltoluene	ND	600	640	110	82.8	ND	120	NA	200
Benzene	170	410	400	4	99.0	320	5	98.4	11
Ethyl Benzene	130	450	460	17	96.3	370	28	92.4	51
Freon 113	ND	ND	ND	ND	NA	ND	ND	NA	7
Heptane	19000	28000	29000	63	99.8	23000	120	99.5	350
Hexane	16000	20000	20000	ND	100.0	16000	24	99.9	220
o-Xylene	730	2000	2100	230	89.0	1000	220	78.0	500
Propylene	ND	ND	ND	ND	NA	ND	ND	NA	81
Styrene	ND	ND	ND	ND	NA	ND	ND	NA	ND
Tetrachloroethene	ND	ND	ND	3	NA	ND	ND	NA	ND
Toluene	360	840	870	69	92.1	ND	3	NA	13
Trichloroethene	190	410	460	51	88.9	370	44	88.1	170
THC[d]	690000	690000	630000	9100	98.6	190	35	81.6	740
						530000	12000	97.7	20000

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See table 2 for field measurements and system operating conditions at the time of sampling.
[b] Parsons ES is having discussions with the field personnel and analytical laboratory to determine if any errors in sample collection and/or analysis may have occurred.
[c] ND = Not detected.
[d] NA = Not available.
[e] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

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TABLE 2

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sampling Date	Sampling Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96	9/2/96	1530	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW/VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW/VW-5	9/19/96															
VEW/VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW/VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW/VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW/VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW/VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1030 hours
VEW/VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW/VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart, @ 15:30 p.m. unit connected to well Q22
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage

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TABLE 2

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sampling Date	Sampling Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75		75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08		69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.

TABLE 3
HYDROCARBON EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[b]	Influent THC[a] Concentration (μg/L)[c]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (μg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23,000	95,614	100	32,000	133,028	69	1192.66
12/9/96	VEW/VW-7	3.13	68,000	282,686	100	NA[d]	NA	7,933	-[e]
12/9/96	VEW/VW-10	0.06	120,000	498,857	100	NA	NA	280	-
12/13/96	VEW/VW-10	3.96	200,000	831,428	100	3,700	15,381	29,518	137.90
12/18/96	VEW/VW-8	4.98	690,000	2,868,427	100	NA	NA	128,069	-
12/24/96	VEW/VW-8	0.04	690,000	2,868,427	100	9,100	37,830	1,072	339.16
12/27/96	VEW/VW-8	3.23	530,000	2,203,284	100	1,200	4,989	63,804	44.72
12/27/96	VEW/VW-9	0.02	20,000	83,143	100	NA	NA	15	-

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).
[b] ppmv = parts per million by volume, as determined by the analytical laboratory.
[c] μg/L = micrograms per liter, as determined by the analytical laboratory.
[d] NA = not analyzed.
[e] Effluent samples not collected during sampling event.

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File: 728414.04000
Job File
Analytical Data Rpt.

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc: P. Guest
M. Vessely
D. Downey

November 12, 1996

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 3, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2 and 3, which constitute Analytical Data Report No. 3 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the week of October 14, 1996 and on October 24, 1996, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO treatment unit was connected to and treating vapors extracted from well VE/VW-6 during the sample collections.

During the week of October 14, 1996, Ms. Kim Makuch (Parsons ES Syracuse) provided oversight during the FTO treatment unit performance tests conducted by Mr. Chris Baer and Mr. Richard Martin (Thermatrix, Inc.). The objective of the tests was to determine the lowest influent oxygen concentration at which the unit can safely operate. They determined that the unit can operate safely at an oxygen concentration of 12 percent, rather than 14 percent at which the unit was previously operating. Ms. Makuch collected four influent and one effluent vapor samples from the FTO treatment unit during this week. The samples were sent to Air Toxics, Ltd. in Folsom, California for analysis by USEPA Method TO-14.

On October 24, 1996, Mr. Dave Brown (Parsons ES Syracuse) collected influent and effluent samples from the FTO treatment unit operating at Site FT-002. Mr. Brown also drained approximately 30 gallons of liquid from the moisture separator. The liquid was discharged to the on-Base groundwater treatment plant for treatment.

Between October 14 and October 18, 1996, the oxygen concentration extracted from well VE/VW-6 increased from 0 percent to 6.5 percent (Table 2). As a result, the flow rate from the well was increased from 34 standard cubic feet per minute (scfm) to 63 scfm.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables have been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rick Jasaitis, OHM
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
FROM WELL VE\VW-6, OCTOBER 14-OCTOBER 24, 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv) [a]		Destruction	Detected Concentration (ppbv)					Destruction
	Influent Sample FT002VW6I1	Effluent Sample FT002VW6E1	Efficiency (percent)	Influent Sample FT002VW6I2	Influent Sample FT002VW6I3	Influent Sample FT002VW6I4	Influent Sample FT002VW6I5	Effluent Sample FT002VW6E2	Efficiency (percent)
1,1-Dichloroethene	ND[b]	ND	NA[c]	1600	ND	ND	ND	ND	NA
1,2-Dichlorobenzene	ND	42	99.21	1600	ND	ND	ND	15	NA
1,3-Dichlorobenzene	ND	15	99.53	5200	ND	ND	ND	ND	NA
1,4-Dichlorobenzene	ND	37	99.69	5000	ND	ND	ND	16	NA
1,1,1-Trichloroethane	ND	24	99.99	ND	ND	ND	ND	ND	NA
1,2,4-Trimethylbenzene	5300	2900	99.00	5200	6300	6500	6800	980	85.59
1,3,5-Trimethylbenzene	3200	1200	98.65	5000	7300	6900	6700	800	88.06
4-Ethyltoluene	ND	1000	99.41	ND	ND	ND	6900	510	92.61
Acetone	ND	ND	NA	ND	ND	ND	16000	ND	100.00
Benzene	12000	160	98.67	20000	22000	24000	16000	130	99.19
Cyclohexane	290000	1300	90.71	410000	430000	ND	ND	ND	NA
Chlorobenzene	ND	350	NA	ND	ND	ND	ND	ND	NA
cis-1,2-Dichloroethene	230000	2500	98.91	430000	460000	410000	280000	1600	99.43
Ethyl Benzene	ND	250	NA	1700	2000	3100	3300	130	96.06
Heptane	89000	770	99.13	260000	310000	390000	360000	1400	99.61
Hexane	170000	470	99.72	350000	360000	360000	240000	340	99.86
m,p-Xylene	12000	2000	83.33	38000	52000	73000	95000	3100	96.74
o-Xylene	14000	2400	82.86	32000	38000	44000	53000	2400	95.47
Styrene	ND	140	NA	ND	ND	ND	ND	ND	NA
Tetrachloroethene	ND	100	NA	ND	ND	ND	ND	ND	NA
Toluene	22000	1200	94.55	5800	74000	90000	90000	1600	98.22
Trichloroethene	1800	220	87.78	12000	17000	28000	29000	210	99.28
Vinyl Chloride	3000	ND	100.00	4500	2500	ND	ND	ND	NA
THC[d]	3300000	120000	96.36	5500000	5500000	5700000	6000000	91000	98.48

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See table 2 for field measurements and system operating conditions at the time of sampling.

[b] ND = Not detected.

[c] NA = Not availible.

[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

022\728414\346.XLS

TABLE 2

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Vapor Sample Number	Extraction Start Date and Time	Sample Date	Sample Time	System Operating Time Elapsed Prior to Sampling (hours: min)	Total Extraction Time (hours:min)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH[a] Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	FT002-MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test, samples collected from influent and effluent
VE/VW-6		9/6/96															
VE/VW-5		9/19/96															
VE/VW-5	FT002-VW5	9/19/1996, 11:00	9/25/96			147:07:00				100							Samples collected from influent and effluent
VE/VW-5		9/30/96															System shutdown identified Sept 30 due to electrical failure
VE/VW-5		10/2/96															System connected to well VE/VW-5 and operational
VE/VW-5		10/3/96															System shutdown identified Oct 3 due to electrical failure
VE/VW-5		10/5/96															System connected to well VE/VW-5 and operational
VE/VW-5		10/8/96															09:00-unit acidently shut down by electrical subcontrator
VE/VW-6	FT002-VW6-12	10/14/96; 15:05	10/14/96	15:34	NA	:29	125	34	66	100	6,800	0	15.2	NM	14	15.2	Initiation of well test and Thermatrix O_2 deficiency test. Sample collected from well inlet.
VE/VW-6	FT002-VW6-E2	10/14/96	10/14/96	15:40	:6	:35	125	34	66	100	6,800	0	15.2	NM	14	15.2	Sample collected from stack.
VE/VW-6	FT002-VW6-12	10/14/96	10/15/96	08:45	17:05	17:40	107	33	67	100	10,400	0	21.5	1,800	13	6.2	Sample collected from well inlet.
VE/VW-6	FT002-VW6-13	10/14/96	10/16/96	14:28	29:43	47:23	130	52	48	100	6,350	0	16	3,900	9.8	7.8	Sample collected from well inlet.
VE/VW-6	FT002-VW6-14	10/14/96	10/18/96	15:35	49:07	96:30	120	63	37	100	6,200	6.5	9.4	4,200	12.1	9.5	Sample collected from well inlet.
VE/VW-6	FT002-VW6-E2	10/14/96	10/24/96	09:40	138:04	234:34	NM	61	39	100	6,200	9	8	3,500	14	5	Sample collected from stack.
VE/VW-6	FT002-VW6-15	10/14/96	10/24/96	09:43	:03	234:37	NM	61	39	100	6,200	9	8	3,500	14	5	Sample collected from well inlet.

[a] TVH = total volatile hydrocarbons measured with direct-reading field instrument

TABLE 3
HYDROCARBON EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Days of Operation	Influent THC[a] Concentration (ppmv)[b]	Influent THC[a] Concentration (µg/L)[c]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (µg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	3.90	5,800	24,111	100.0	2.8	12	842.2	0.10
9/25/96	6.13	3,600	14,966	100.0	18.0	75	821.8	0.67
10/14/96	0.02	3,300	13,719	100.0	120.0	499	2.6	4.47
10/24/96	10.00	6,000	24,943	100.0	91.0	378	2,236.2	3.39

a/ Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

b/ ppmv = parts per million by volume, as determined by the analytical laboratory.

c/ µg/L = micrograms per liter, as determined by the analytical laboratory.

APPENDIX B

ANALYTICAL DATA REPORTS 1 THROUGH 7

F.L 728414.04000
Job Files
Analytical Data Report

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc P Must
M Vessely
D Downey
G. Cyr.

April 14, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 7, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2, and 3 which constitute Analytical Data Report No. 7 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of March 1997, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO demonstration at this site has been completed and the FTO unit was shut down at 13:57 hours on March 25, 1997, and removed from the site at 13:00 hours on March 27, 1997. The March samples were collected using the revised sampling procedures described in Parsons ES's March 13, 1997 letter to Mr. Chuck Wright (Thermatrix, Inc.) (see Attachment 1). The destruction efficiency of the FTO Unit, calculated using March 1997 data, exceeded 99.87 percent of all targeted compounds. This data report is being sent within 4 working days of receipt of the final analytical laboratory results report. The March 1997 data represent the following FTO treatment unit operating conditions:

- On March 5, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during the sample collection. Results for these samples are used to evaluate the efficiency of the FTO treatment unit to destroy volatile organic compounds (VOCs) in a gas stream that is a mixture of fuel hydrocarbons and chlorinated solvents. Well VE/VW-6 was selected because it had the highest detected total volatile hydrocarbon (TVH) concentration (6,000 ppmv), and the lowest oxygen concentration (0 percent initially), and well VE/VW-14 was selected because it had a high detected trichlorethene (TCE) concentration (35 ppmv).

- On March 6, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during the sample collection. Following sample collection, Parsons ES switched the FTO treatment unit to begin treating and extracting vapors from well VE/VW-6 only. This well was selected to evaluate the efficiency of the FTO treatment unit to treat a VOC vapor stream that is primarily contaminated with fuel hydrocarbons.

- On March 11, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-6 during the sample collection.

- On March 12, 1997, at 15:21 hours, the FTO treatment unit shutdown during sample collection. An electrical short in the sampling pump caused the unit to shut down. The unit was restarted on March 14, 1997 at 23:47 hours, and continued to extract and treat vapors from well VE/VW-6. Therefore, the unit was down for a total of 56.50 hours.

- On March 18, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-6 during the sample collection. Following sample collection, Parsons ES switched the FTO treatment unit to begin treating and extracting vapors from well VE/VW-14 only. This well was selected to evaluate the efficiency of the FTO treatment unit to destroy a VOC vapor stream contaminated primarily with chlorinated solvents.

- On March 19, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collection.

- On March 20, 1997, Parsons ES collected influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collection.

- On March 25, 1997, Parsons ES collected final influent (after dilution air was added) and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collection. Following final sample collection, at 13:57 hours the FTO treatment unit was shut down to begin demobilization of the FTO unit from Plattsburgh AFB.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-

ATTACHMENT 1

REVISED SAMPLING PROCEDURES

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway. Suite 900 • Denver. Colorado 80290 • (303) 831-8100 • Fax (303) 831-8208

March 13, 1997

Mr. Chuck Wright
Thermatrix, Inc.
308 N. Peters Road, Suite 225
Knoxville, Tennessee 37922

Subject: Air Force Contract No. F41624-94-D-8136, Delivery Order 28
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Thermatrix Sampling Procedure Recommendations for Air Force Unit at Plattsburgh, New York

Dear Mr. Wright:

The purpose of this letter is to provide a response to Mr. Marshall Allen's (Thermatrix, Inc.) memorandum dated February 21, 1997, and Mr. Rick Martin's (Thermatrix, Inc.) memorandum received via facsimile on March 4, 1997, regarding the sampling procedures used by Parsons Engineering Science, Inc. (Parsons ES) to evaluate the performance of the Thermatrix flameless thermal oxidizer (FTO) treatment unit operating at Plattsburgh, New York. Parsons ES agrees that analytical data reported in Analytical Data Reports 1 through 5 cannot be used to accurately determine the destruction removal efficiency (DRE) of the FTO treatment unit because inlet vapor samples were not collected following the addition of dilution air. Parsons ES will be collecting these inlet samples during the next 4 weeks of FTO treatment unit operation following the procedures provided below:

Influent Sampling

The influent vapor stream to the oxidizer will be sampled as follows:

Location: Influent to the oxidizer, exhaust side of the blower, combined vapor stream location.

Procedure: Using a new Tedlar® bag, connect the bag with a new short piece of Tygon® tubing to the combined sampling port. Open the valve on the sampling port to allow the Tedlar® bag to fill. Fill and evacuate the bag three times prior to collecting a sample. Once the Tedlar® bag is purged three times, fill the bag a final time, and collect a sample. Following sample collection, close both the Tedlar® bag and sampling port valve, before removing the bag from the sampling port.

Preparing the SUMMA® canister will consist of testing its vacuum both prior to (initial) and following sample collection. Once the initial vacuum is checked, the filled Tedlar® bag will be connected to a 1-liter SUMMA®canister. The bag valve will be opened, and then the SUMMA® canister valve will be opened slowly to allow the Tedlar® bag sample to enter the SUMMA® canister. Once the canister is full, the valve will be closed, and the SUMMA® canister will be prepared for shipment. SUMMA® canister filters will not be needed during influent sampling.

Effluent Sampling

The effluent vapor stream to the oxidizer will be sampled as follows:

Location: Oxidizer effluent within the center of stack opening approximately 6 inches below the top of the stack.

Procedure: Place the copper tubing into the stack so that one end is approximately 6 inches below the top of the stack and located in the center of the stack annulus. Connect a 1-cfm sampling pump to the other end of the copper tubing via Tygon® tubing to purge the tubing. An inline "tee" is placed approximately 3 feet from the top of the oxidizer exhaust within the copper tubing from which the SUMMA® canister sample will be collected. After purging the sample tube for at least 15 to 30 seconds, and continuing to purge using the 1-cfm pump, the SUMMA® canister sample will be collected through the inline "tee" via a short piece of dedicated rigid copper tubing fitted with the appropriated adapters in order to attach the SUMMA® canister. At this sample collection point a new, laboratory-supplied, prefilter will be attached to the canister inlet to prevent any particulates or moisture from entering the canister. Once the canister is completely evacuated, the valve will be closed, and the canister will be prepared for shipment.

Quality Control Sampling

Prior to the first sampling event, a quality control (QC) effluent sample will be collected from the copper sampling tube. The QC sample will be collected in the field next to the system and would be considered a combination field and equipment blank. This SUMMA® canister sample will identify whether the tubing or ambient air could be contributing to any VOC detections in the effluent sample. The copper tubing will be purged a minimum of 15 seconds with ambient air using the 1-cfm pump prior to sample collection.

Parsons ES appreciates Thermatrix, Inc.'s comments and time that Marshall Allen and Rick Martin have taken to discuss the sampling procedures with Steve Archabal (Parsons ES, Site Manager).

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest, P.E.
Project Manager

cc: Marshall Allen, Thermatrix, Inc.
Rick Martin, Thermatrix, Inc.
Jim Gonzales, AFCEE/ERT
Mr. Brady Baker, AFBCA/OL3A
Mr. Ken Kukkonen, OHM
Mr. Rich Jasaitis, OHM
Doug Downey, Parsons ES-Denver
Steve Archabal, Parsons ES-Phoenix
Dave Brown, Parsons ES-Syracuse
File 728414

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
MARCH 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a]						
Analyte	Influent Sample FT002VW6&14C1 3/5/97	Effluent Sample FT002VW6&14EN1 3/5/97	Destruction Efficiency (percent)	Ambient Sample FT002BLANK-1 3/6/97	Influent Sample FT002VW6&14C2 3/6/97	Effluent Sample FT002VW6&14EN2 3/6/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	6800	ND[b]	100	760	11000	ND	100.00
1,2-Dichlorobenzene	ND	ND	NA	14	ND	ND	NA
1,3,5-Trimethylbenzene	4100	ND	100	390	6700	ND	100.00
1,4-Dichlorobenzene	ND	ND	NA	5	ND	ND	NA
4-Ethyltoluene	5800	ND	100	520	9000	ND	100.00
Benzene	3700	ND	100	12	5200	5	99.90
cis-1,2-Dichloroethene	60000	ND	100	140	80000	55	99.93
Ethyl Benzene	920	ND	100	36	1400	ND	100.00
Freon 113	ND	ND	NA	ND	ND	ND	NA
Heptane	58000	ND	100	90	85000	60	99.93
Hexane	50000	ND	100	22	70000	21	99.97
m,p-Xylene	24000	ND	100	1100	35000	33	99.91
o-Xylene	14000	ND	100	790	21000	20	99.90
Tetrachloroethene	ND	ND	NA	ND	ND	ND	NA
Toluene	21000	ND	100	300	29000	38	99.87
Trichloroethene	12000	ND	100	73	16000	19	99.88
THC[c]	1500000	ND	100	12000	1700000	860	99.95

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TABLE 1 (Continued)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
MARCH 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)								
Analyte	Influent Sample FT002VW6&14C2 DUP 3/6/97	Effluent Sample FT002VW6&14EN2-DUP 3/6/97	Destruction Efficiency (percent)	Influent Sample FT002VW6C1 3/11/97	Effluent Sample FT002VW6EN1 3/11/97	Destruction Efficiency (percent)	Influent Sample FT002VW6C2 3/18/97	Effluent Sample FT002VW6EN2 3/18/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	9900	280	97.17	11000	7	99.94	5900	ND	100.00
1,2-Dichlorobenzene	ND	ND	NA	ND	ND	NA	ND	ND	NA
1,3,5-Trimethylbenzene	6300	160	97.46	7600	5	99.93	4600	ND	100.00
1,4-Dichlorobenzene	ND	ND	NA	ND	ND	NA	ND	ND	NA
4-Ethyltoluene	8300	220	97.35	9300	ND	100.00	9000	ND	100.00
Benzene	ND	8	NA	5000	ND	100.00	7100	ND	100.00
cis-1,2-Dichloroethene	83000	98	99.88	80000	7	99.99	120000	ND	100.00
Ethyl Benzene	1300	19	98.54	1500	ND	100.00	1700	ND	100.00
Freon 113	ND	ND	NA	ND	ND	NA	ND	ND	NA
Heptane	82000	75	99.91	94000	ND	100.00	99000	ND	100.00
Hexane	72000	ND	100.00	80000	ND	100.00	82000	ND	100.00
m,p-Xylene	33000	540	98.36	40000	14	99.97	38000	ND	100.00
o-Xylene	20000	380	98.10	24000	9	99.96	19000	ND	100.00
Tetrachloroethene	ND	ND	NA	ND	ND	NA	ND	ND	NA
Toluene	29000	180	99.38	30000	6	99.98	35000	ND	100.00
Trichloroethene	16000	45	99.72	15000	4	99.97	22000	ND	100.00
THC	2400000	5000	99.79	2300000	1400	99.94	2600000	ND	100.00

TABLE 1 (Continued)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
MARCH 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)									
Analyte	Influent Sample FT002VW14C1 3/19/97	Influent Sample FT002VW14C1 DUP 3/19/97	Effluent Sample FT002VW14EN1 3/19/97	Destruction Efficiency (percent)	Influent Sample FT002VW14C2 3/20/97	Effluent Sample FT002VW14EN2 3/20/97	Destruction Efficiency (percent)	Influent Sample FT002VW14C3 3/25/97	Effluent Sample FT002VW14EN3 3/25/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	760	810	7	99.08	220	ND	100.00	ND	ND	NA[c]
1,2-Dichlorobenzene	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA
1,3,5-Trimethylbenzene	460	560	ND	100.00	150	ND	100.00	ND	ND	NA
1,4-Dichlorobenzene	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA
4-Ethyltoluene	700	780	ND	100.00	ND	ND	NA	ND	ND	NA
Benzene	ND	ND	9	NA	ND	ND	NA	ND	ND	NA
cis-1,2-Dichloroethene	1700	1600	ND	100.00	1600	ND	100.00	1900	ND	100.00
Ethyl Benzene	ND	ND	16	NA	160	ND	100.00	ND	ND	NA
Freon 113	180	140	ND	100.00	140	ND	100.00	99	ND	100.00
Heptane	2500	2900	31	98.76	2200	ND	100.00	ND	ND	NA
Hexane	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA
m,p-Xylene	1100	1000	22	98.00	460	ND	100.00	ND	ND	NA
o-Xylene	650	710	8	98.77	230	ND	100.00	200	ND	100.00
Tetrachloroethene	220	180	ND	100.00	240	ND	100.00	320	ND	100.00
Toluene	300	340	38	87.33	280	ND	100.00	ND	ND	NA
Trichloroethene	31000	31000	ND	100.00	24000	ND	100.00	19000	ND	100.00
THC	170000	130000	240	99.86	83000	ND	100.00	98000	ND	100.00

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See Table 3 for field measurements and system operating conditions at the time of sampling.

[b] ND = Not detected.

[c] NA = Not applicable.

[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 2
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1030 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW- and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected

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TABLE 2
FIELD MEASUREMENTS
FOR THERMATRIX SAMPLING EVENTS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	93.08											Closed VEW/VW-12
VEW/VW-13	1/7/97, 1505															Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	NA	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	162.00											Closed VEW/VW-13
VEW/VW-10	1/14/97, 1020															Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	NA	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	82.17											System shutdown due to weather-related low propane pressure.
-	1/21/97, 1515															System operational, TIC-315 control setpoint changed to 1200deg F
	1/22/97, 0400															System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634															System operational
VEW/VW-3	1/22/97, 1708															Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	NA	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300															System shutdown due to weather-related low propane pressure.
	1/27/97, 1600															System operational
	1/27/97, 1825															Opened VEW/VW-4
VEW/VW-4		1/27/97	2030	NA	2.10	94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected
VEW/VW-4		2/3/97	1225	159.90	162.00	114	47.9	52.1	100	1200	7.7	8.7	575	14.5	4.7	Sample collected
VEW/VW-4	2/3/97, 1235															Closed VEW/VW-4

TABLE 2

FIELD MEASUREMENTS

FOR THERMATRIX SAMPLING EVENTS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-2	2/3/97, 1305															Opened VEW/VW-2
VEW/VW-2		2/3/97	1507	NA	2.03	114	82.4	17.6	100	170	17.5	3.7	140	18.7	2.5	Sample Collected
VEW/VW-2		2/4/97	1301	21.90	24.00	109	80.4	19.6	100	230	18	3.5	185	19.3	2.3	Sample Collected
VEW/VW-2	2/4/97, 1325															Closed VEW/VW-2
VEW/VW-11	2/5/97, 1350															Opened VEW/VW-11
VEW/VW-11		2/5/97	1452	NA	1.03	109	75.0	25.0	100	160	19.7	2	120	20.3	1.3	Sample Collected
VEW/VW-11		2/7/97	1117	44.40	45.43	110	75.0	25.0	100	160	20.2	1.7	120	20.7	0.8	Sample Collected
VEW/VW-11	2/7/97, 1148															Closed VEW/VW-11
VEW/VW-6&14	2/7/97, 1204															Opened VEW/VW-6&14
VEW/VW-6&14		2/7/97	1310	NA	1.10	110	63.3	36.7	100	1500	6.7	10.8	950	14.7	5.7	Sample Collected
VEW/VW-6&14		2/19/97	0906	283.90	285.00	130	75.4	24.6	100	3050	9.9	7.8	2300	13.8	5.7	Sample Collected
VEW/VW-6&14		2/21/97	1200	61.10	337.10	113	63.5	36.5	100	2600	11	7.2	1650	15.8	4.2	Sample Collected
VEW/VW-6&14		2/24/97	0839	68.70	405.80	106	63.9	36.1	100	1800	11.1	7.2	1150	17	3.7	Sample Collected
VEW/VW-6&14		3/5/97	1630	224.20	630.00	112	60.0	40.0	100	3500	12	6.5	2100	17.1	3.1	Sample Collected, QA,QC samples collected
VEW/VW-6&14		3/6/97	1030	18.00	648.00	106	66.7	33.3	100	3900	11.8	6.5	2600	15.8	4	Sample Collected
VEW/VW-6&14	3/6/97, 1245															Closed VEW/VW-14
VEW/VW-6	3/6/97,1300															Operating exclusively on VEW/VW-6
VEW/VW-6		3/11/97	1530	NA	122.50	118	66.7	33.3	100	4200	14	5.5	2800	16.8	3.3	Sample Collected
VEW/VW-6	3/12/97, 1521															System Shutdown. Sample pump shorted out system.
VEW/VW-6	3/14/97, 2347															System Restart, Operating on VEW/VW-6
VEW/VW-6		3/18/97	1625	112.50	235.00	146	89.7	10.3	100	3900	15.2	4.5	3500	16	4	Sample Collected
VEW/VW-6	3/18/97, 1700															Closed VEW/VW-6
VEW/VW-14	3/18/97, 1715															Opened VEW/VW-14
VEW/VW-14		3/19/97	1645	NA	23.50	150	62.5	37.5	100	640	15.9	4	400	18	2.1	Sample Collected
VEW/VW-14		3/20/97	1720	24.40	47.90	148	74.6	25.4	100	590	13.8	4.1	440	16.9	2.6	Sample Collected
VEW/VW-14		3/25/97	1337	116.30	164.20	140	78.7	21.3	100	375	16.7	3.9	295	18.3	2.6	Sample Collected
VEW/VW-14	3/25/97, 1420															Closed VEW/VW-14, Final System Shutdown

TABLE 3
HYDROCARBON MASS REMOVAL AND EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[c]	(μg/L)[d]	Flow Rate (scfm)	Effluent THC Concentration[b] (ppmv)	(μg/L)	Pounds of THC Removed	Total Daily THC Emissions[b] (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23	96	100	32	133	0	1.19
12/9/96	VEW/VW-7	3.13	68	283	100	NA[e]	NA	8	-[f]
12/9/96	VEW/VW-14	0.06	120	499	100	NA	NA	0	-
12/13/96	VEW/VW-14	3.96	200	831	100	4	15	30	0.14
12/18/96	VEW/VW-8	4.98	690	2,868	100	NA	NA	128	-
12/24/96	VEW/VW-8	0.04	690	2,868	100	9	38	1	0.34
12/27/96	VEW/VW-8	3.23	530	2,203	100	12	50	64	0.45
12/27/96	VEW/VW-9	0.02	20	83	100	NA	NA	0	-
1/3/97	VEW/VW-9	6.83	18	75	100	4	18	5	0.16
1/3/97	VEW/VW-12	0.19	180	748	100	5	21	1	0.19
1/7/97	VEW/VW-12	3.66	580	2,411	100	NA	NA	79	-
1/7/97	VEW/VW-13	0.04	490	2,037	100	26	108	1	0.97
1/14/97	VEW/VW-13	6.75	180	748	100	NA	NA	45	-
1/14/97	VEW/VW-10	0.20	550	2,286	100	NA	NA	4	-
1/22/97	VEW/VW-3	4.42	1,200	4,989	100	24	100	198	0.89
1/27/97	VEW/VW-4	0.08	ND	ND	100	ND	ND	0	-
2/3/97	VEW/VW-4	12.67	870	3,617	100	NA	NA	411	-
2/3/97	VEW/VW-2	0.08	12	50	100	3	13	0.04	0.12
2/4/97	VEW/VW-2	0.92	13	54	100	NA	NA	0.4	-
2/4/97	VEW/VW-11	0.08	25	104	100	4	17	0.1	0.16
2/7/97	VEW/VW-11	2.84	24	100	100	NA	NA	3	-
2/7/97	VEW/VW-6 and -14	0.40	1,500	6,236	100	32	133	22	1.19
2/19/97	VEW/VW-6 and -14	11.92	3,700	15,381	100	88	366	1,644	3.28
2/21/97	VEW/VW-6 and -14	1.88	3,800	15,797	100	140	582	266	5.22
2/24/97	VEW/VW-6 and -14	2.85	4,200	17,460	100	220	915	446	8.20
3/5/97	VEW/VW-6 and -14	9.34	1,500	6,236	100	0	0	522	0.00
3/6/97	VEW/VW-6 and -14	0.75	1,700	7,067	100	0.9	4	48	0.03
3/11/97	VEW/VW-6	0.10	2,300	9,561	100	1.4	6	9	0.05
3/18/97	VEW/VW-6	3.69	2,600	10,809	100	0	0	358	0.00
3/19/97	VEW/VW-14	0.98	170	707	100	0.2	1	6	0.01
3/20/97	VEW/VW-14	1.02	83	345	100	0	0	3	0.00
3/25/97	VEW/VW-14	4.85	98	407	100	0	0	18	0.00
							Total =	8,221	

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] Effluent sample results from samples collected from 9/2/96 through 2/24/97 may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the sample. procedures that may have caused cross-contamination of the sample (see Attachment 1).

[c] ppmv = parts per million by volume, as determined by the analytical laboratory.

[d] μg/L = micrograms per liter, as determined by the analytical laboratory.

[e] NA = not analyzed.

[f] Effluent samples not collected during sampling event.

File 728414.04000
Job Files
Analytical Data Reports.

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc: P. Guest.
M. Vessely.
D. Downey.
✓ R. Martin (Thermatrix via fax)
Done.

March 20, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 6, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2, 3, and 4, which constitute Analytical Data Report No. 6 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of February 1997, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO unit operated for the entire month of February. Please note that effluent sample results may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the samples. Parsons ES and Thermatrix have developed revised sampling procedures that are being implemented for all SUMMA® canister vapor samples collected in March. The results for these samples will be presented in the next analytical data report. The February 1997 data represent the following FTO treatment unit operating conditions:

- On February 3, 1997, Parsons ES collected an influent SUMMA® canister vapor sample from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-4 during sample collection. Photoionization detector (PID) readings increased from a volatile organic compound (VOC) concentration of 570 parts per million by volume (ppmv) on January 27, 1997, to 1,200 ppmv at the time of sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-2. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 2 hours of vapor extraction from well VE/VW-2.

- On February 4, 1997, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-2 during sample collection. Well VE/VW-2 PID readings increased from a VOC concentration of 170 ppmv on February 3, 1997, to 230 ppmv at the time of sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-11. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 2 hours of vapor extraction from well VE/VW-11.

- On February 5, 1997, Parsons ES collected SUMMA® canister samples from well VE/VW-1, VE/VW-3, and MW-108 following approximately 4 hours of purging with a 10-standard-cubic-foot-per-minute (scfm) pump. The analytical results for the sample from well VE/VW-3 will be used to verify the accuracy of the analytical results for the first sample collected from well VE/VW-3, in which no specific VOCs were detected above the method detection limit, although total volatile hydrocarbons (TVH) were reported at 1,000 ppmv.

- On February 7, 1997, the FTO treatment unit was connected to and began treating and extracting vapors from wells VE/VW-6 and VE/VW-14. These two wells were selected for combined extraction because well VE/VW-6 had the highest detected TVH concentration (6,000 ppmv), and the lowest oxygen concentration (0 percent initially), and well VE/VW-14 had the highest TCE concentrations (120 ppmv initially, and 71 ppmv after 93 hours of FTO operation).

- On February 19, 1997, Parsons ES collected influent and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during sample collection. PID readings increased from a VOC concentration of 1,500 ppmv on February 7, 1997, to 3,050 ppmv at the time of sample collection.

- On February 21, 1997, Parsons ES collected influent and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during sample collection. PID readings decreased from a VOC concentration of 3,050 ppmv on February 19, 1997, to 2,600 ppmv at the time of sample collection.

- On February 24, 1997, Parsons ES collected influent and effluent SUMMA® canister vapor samples from the FTO treatment unit, which was extracting and treating vapors from wells VE/VW-6 and VE/VW-14 during sample collection. PID readings decreased from a VOC concentration of 2,600 ppmv on February 21, 1997, to 1,800 ppmv at the time of sample collection.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Mark Vessely
for
Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Chuck Wright, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
FEBRUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a/]						
Analyte	Influent Sample FT002VW4I2 2/3/97	Influent Sample FT002VW2I1A 2/3/97	Effluent Sample[b/] FT002VW2E1A 2/3/97	Influent Sample FT002VW2I2 2/4/97	Influent Sample FT002VW11I1A 2/4/97	Effluent Sample[b/] FT002VW11E1A 2/4/97	Influent Sample FT002VW11I2A 2/7/97
1,1-Dichloroethene	ND[c/]	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	1500	350	160	230	140	70	200
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	780	150	62	110	68	31	100
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
2-Butanone (Methyl Ethyl Ketone)	ND	ND	ND	ND	ND	ND	ND
4-Bromofluorobenzene	102	103	99	NA	NA[d/]	NA	102
4-Ethyltoluene	1300	180	74	130	ND	35	120
Acetone	ND	ND	15	ND	ND	ND	ND
Benzene	320	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	170	36	4	41	370	4	490
Ethyl Benzene	1500	39	16	18	ND	ND	ND
Freon 113	ND	19	ND	20	1100	ND	510
Heptane	31000	58	18	28	ND	ND	ND
Hexane	14000	ND	ND	ND	ND	ND	ND
m,p-Xylene	6100	290	130	220	110	56	170
Methylene Chloride	150	11	16	ND	ND	ND	ND
o-Xylene	1600	170	80	190	90	55	160
Octafluorotoluene	104	102	108	NA	NA	NA	104
Tetrachloroethene	ND	14	ND	11	1700	45	810
Tetrahydrofuran	ND	ND	ND	ND	350	ND	ND
THC[e/]	870000	12000	3100	13000	25000	4200	24000
Toluene	380	28	15	58	ND	12	33
Toluene-d8	102	99	100	NA	NA	NA	99
Trichloroethene	110	1400	35	1200	13000	180	7100

TABLE 1 (concluded)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
FEBRUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

	Detected Concentration (ppbv)[a]							
Analyte	Influent Sample FT002VW6&14I 2/7/97	Effluent Sample[b] FT002VW6&14E1 2/7/97	Influent Sample FT002VW6&14I2 2/19/97	Effluent Sample[b] FT002VW6&14E2 2/19/97	Influent Sample FT002VW6&14I3 2/21/97	Effluent Sample[b] FT002VW6&14E3 2/21/97	Influent Sample FT002VW6&14I4 2/24/97	Effluent Sample[b] FT002VW6&14E4 2/24/97
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	1000	290	6600	2300	9900	5100	4500	4200
1,2-Dichlorobenzene	ND	16	ND	53	ND	71	ND	38
1,3,5-Trimethylbenzene	1400	310	5600	1200	7200	2800	4000	2700
1,3-Dichlorobenzene	ND	4	ND	8	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	9	ND	20	ND	31	ND	ND
2-Butanone (Methyl Ethyl Ketone)	ND	54	ND	ND	ND	ND	ND	ND
4-Bromofluorobenzene	101	113	NA	NA	ND	ND	ND	ND
4-Ethyltoluene	1000	190	6100	1300	9400	3300	5900	3600
Acetone	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	3200	36	10000	140	8100	170	9100	200
cis-1,2-Dichloroethene	66000	700	190000	2200	140000	2600	160000	2800
Ethyl Benzene	ND	13	1300	94	1400	210	1400	250
Freon 113	340	ND	ND	ND	ND	ND	ND	ND
Heptane	35000	150	180000	930	130000	1400	140000	2400
Hexane	47000	62	170000	290	120000	390	120000	630
m,p-Xylene	7000	590	34000	2900	48000	7800	43000	9600
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	7000	750	21000	2500	28000	5600	23000	6500
Octafluorotoluene	103	107	NA	NA	ND	ND	ND	ND
Tetrachloroethene	ND	7	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	47	ND	ND	ND	ND	ND	ND
THC	1500000	32000	3700000	88000	3800000	140000	4200000	220000
Toluene	11000	370	49000	1700	42000	2700	48000	3200
Toluene-d8	106	102	NA	NA	ND	ND	ND	ND
Trichloroethene	35000	650	18000	360	28000	840	19000	610

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See Table 3 for field measurements and system operating conditions at the time of sampling.

[b] Effluent sample results may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the sample.

[c] ND = Not detected.

[d] NA = Not available.

[e] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 2
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES FROM VENT WELLS[a]
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	FT002VW111 Detected Concentration 2/17/97 (ppbv)[b]	FT002VW211 Detected Concentration 2/17/97 (ppbv)	FT002VW311 Detected Concentration 2/17/97 (ppbv)	FT002VW411 Detected Concentration 2/17/97 (ppbv)	FT002VW1111 Detected Concentration 2/17/97 (ppbv)	FT002-MW108-11 Detected Concentration 2/5/97 (ppbv)	FT-002MW108-11 Duplicate Detected Concentration 2/5/97 (ppbv)	FT002-VW1-12 Detected Concentration 2/5/97 (ppbv)	FT002-VW3-1X Detected Concentration 2/5/97 (ppbv)
1,1-Dichlorobenzene	ND[c]	ND	ND	ND	ND	1800	1900	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	24000	21000	220	1300
1,3,5-Trimethylbenzene	ND	ND	ND	ND	ND	11000	10000	98	800
4-Bromoflorobenzene	ND	ND	ND	ND	ND	97	99	100	104
4-Ethyltoluene	ND	ND	ND	ND	ND	20000	19000	96	ND
Benzene	ND	ND	ND	ND	ND	28000	28000	ND	ND
cis-1,2-Dichloroethene	ND	38	ND	ND	330	460000	460000	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	25000	25000	20	340
Freon 113	ND	14	ND	ND	1200	ND	ND	ND	ND
Heptane	ND	ND	ND	4500	ND	140000	140000	38	36000
Hexane	ND	ND	ND	1300	ND	210000	200000	19	8000
m,p-Xylene	ND	ND	ND	170	ND	140000	140000	160	1800
Methylene Chloride	ND	ND	ND	ND	ND	2000	1100	4	390
o-Xylene	ND	ND	ND	ND	ND	48000	48000	160	900
Octafluorotoluene	ND	ND	ND	ND	ND	97	99	100	104
Tetrachloroethene	67	14	ND	ND	1500	ND	ND	69	ND
Tetrahydrofuran	130	140	ND	ND	560	ND	ND	ND	ND
THC[d]	400	2000	1100000	210000	21000	6800000	6400000	5100	2300000
Toluene	ND	ND	ND	ND	ND	140000	140000	39	ND
Toluene -d8	NA[e]	NA	NA	NA	NA	102	102	99	103
Trichloroethene	ND	1700	ND	ND	13000	300000	300000	7	ND

[a] SUMMA canister samples collected following approximately 2 hours of purging with a 10-scfm pump.
[b] ppbv = parts per billon volume, as determined by Air Toxics, Folsum, CA using USEPA Method TO-14 GC/MS Full Scan.
[c] ND = Not detected.
[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).
[e] NA = Not analyzed.

TABLE 3
FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	VOCs Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	VOCs After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure, summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage

TABLE 3 (Continued)
FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	VOCs Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	VOCs After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	93.08											Closed VEW/VW-12
VEW/VW-13	1/7/97, 1505															Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	NA	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	162.00											Closed VEW/VW-13
VEW/VW-10	1/14/97, 1020															Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	NA	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	82.17											System shutdown due to weather-related low propane pressure.
	1/21/97, 1515															System operational. TIC-315 control setpoint changed to 1200deg.F
	1/22/97, 0400															System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634															System operational
VEW/VW-3	1/22/97, 1708															Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	NA	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300															System shutdown due to weather-related low propane pressure.
	1/27/97, 1600															System operational
	1/27/97, 1825															Opened VEW/VW-4
VEW/VW-4		1/27/97	2030	NA	2.10	94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected
VEW/VW-4		2/3/97	1225	139.90	114.00	47.9	52.1	52.1	100	1200	7.7	8.7	575	14.5	4.7	Sample collected
VEW/VW-4	2/3/97															Closed VEW/VW-4
VEW/VW-2	2/3/97 1305															Opened VEW/VW-2
VEW/VW-2		2/397	1509	NA	2.00	114	82.4	17.6	100	170	17.5	3.7	140	18.7	2.5	Sample collected

TABLE 3 (Continued)

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	VOCs Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	VOCs After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-2		2/4/97	1304	21.90	24.00	109	80.4	19.6	100	230	18	3.5	185	19.3	2.5	Sample collected
VEW/VW-2	2/4/97 1325															Closed VEW/VW-2
VEW/VW-11	2/4/97 1350															Opened VEW/VW-11
VEW/VW-11		2/4/97	1457	NA	1.08	109	75.0	25.0	100	160	19.7	2	120	20.3	1.3	Sample collected
VEW/VW-11		2/7/97	1117	44.40	45.43	110	75.0	25.0	100	160	20.2	1.7	120	20.7	0.8	Sample collected
VEW/VW-11	2/7/97 1148															Closed VEW/VW-11
VEW/VW-6&-14	2/7/1997 1204															Opened VEW/VW-6&14
VEW/VW-6&-14		2/7/97	1310	NA	1.10	110	63.3	36.7	100	1500	6.7	10.8	950	14.7	5.7	Sample collected
VEW/VW-6&-14		2/19/97	906	283.90	285.00	130	75.4	24.6	100	3050	9.9	7.8	2300	13.8	5.7	Sample collected
VEW/VW-6&-14		2/21/97	1200	61.10	337.10	112	63.5	36.5	100	2600	11	7.2	16.5	15.8	4.2	Sample collected
VEW/VW-6&-14		2/24/97	839	68.70	405.80	106	63.9	36.1	100	1800	11.1	7.2	1150	17	3.7	Sample collected, QA/QC sample collected
VEW/VW-6&-14		3/5/97	1630	224.20	630.00	112	70.0	30.0	100	3500	12	6.5	2100	17.1	3.1	Sample collected
VEW/VW-6&-14		3/6/97	1030	18.00	648.00	106	66.7	33.3	100	3900	11.8	6.5	2600	15.8	4	Sample collected
VEW/VW-6&-14	3/6/1997 1245															Closed VEW/EW-14
VEW/VW-6	3/6/97 1300															Operating on VEW/VW-6 exclusively
VEW/VW-6	3/11/97	3/11/97	1530	NA	122.50	118	70.0	30.0	100	4200	14	5.5	2800	16.8	3.3	Sample Collected
VEW/VW-6	3/12/97		1521													System shutdown, sample pump shorted out the unit.
VEW/VW-6	3/14/97															System online and on VEW/VW-6

TABLE 4
HYDROCARBON REMOVAL AND EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[c]	Influent THC[a] Concentration (μg/L)[d]	Flow Rate (scfm)	Effluent THC Concentration[b] (ppmv)	Effluent THC Concentration[b] (μg/L)	Pounds of THC Removed	Total Daily THC Emissions[b] (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23	96	100	32	133	0	1.19
12/9/96	VEW/VW-7	3.13	68	283	100	NA[e]	NA	8	-[f]
12/9/96	VEW/VW-14	0.06	120	499	100	NA	NA	0	-
12/13/96	VEW/VW-14	3.96	200	831	100	4	15	30	0.14
12/18/96	VEW/VW-8	4.98	690	2,868	100	NA	NA	128	-
12/24/96	VEW/VW-8	0.04	690	2,868	100	9	38	1	0.34
12/27/96	VEW/VW-8	3.23	530	2,203	100	12	50	64	0.45
12/27/96	VEW/VW-9	0.02	20	83	100	NA	NA	0	-
1/3/97	VEW/VW-9	6.83	18	75	100	4	18	5	0.16
1/3/97	VEW/VW-12	0.19	180	748	100	5	21	1	0.19
1/7/97	VEW/VW-12	3.66	580	2,411	100	NA	NA	79	-
1/7/97	VEW/VW-13	0.04	490	2,037	100	26	108	1	0.97
1/14/97	VEW/VW-13	6.75	180	748	100	NA	NA	45	-
1/14/97	VEW/VW-10	0.20	550	2,286	100	NA	NA	4	-
1/22/97	VEW/VW-3	4.42	1,200	4,989	100	24	100	198	0.89
1/27/97	VEW/VW-4	0.08	ND	ND	100	ND	ND	0	-
2/3/97	VEW/VW-4	12.67	870	3,617	100	NA	NA	411	-
2/3/97	VEW/VW-2	0.08	12	50	100	3	13	0.04	0.12
2/4/97	VEW/VW-2	0.92	13	54	100	NA	NA	0.4	-
2/4/97	VEW/VW-11	0.08	25	104	100	4	17	0.1	0.16
2/7/97	VEW/VW-11	2.84	24	100	100	NA	NA	3	-
2/7/97	VEW/VW-6 and -14	0.40	1,500	6,236	100	32	133	22	1.19
2/19/97	VEW/VW-6 and -14	11.92	3,700	15,381	100	88	366	1,644	3.28
2/21/97	VEW/VW-6 and -14	1.88	3,800	15,797	100	140	582	266	5.22
2/24/97	VEW/VW-6 and -14	2.85	4,200	17,460	100	220	915	446	8.20

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] Effluent sample results may be anomolously high due to the use of sampling procedures that may have caused cross-contamination of the sample.

[c] ppmv = parts per million by volume, as determined by the analytical laboratory.

[d] μg/L = micrograms per liter, as determined by the analytical laboratory.

[e] NA = not analyzed.

[f] Effluent samples not collected during sampling event.

File: 728414.04
Job Files
Analytical Data Rpt

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc: P Guest
M. Vessely
D. Downey (FYI)

February 20, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 5, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2, 3, and 4, which constitute Analytical Data Report No. 5 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of January 1997, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO unit operated 25.7 days during the month of January. The January 1997 data represent the following FTO treatment unit operating conditions:

- On January 3, 1997, Engler Electric heat traced the piping from the FTO treatment unit to the soil vapor extraction (SVE) building at Site FT-002.
- On January 3, 1997, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-9 during the sample collection. Photoionization detector (PID) readings for influent vapors decreased from a concentration of 135 parts per million by volume (ppmv) on December 27, 1996, to 40 ppmv at the time of sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-12. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 4 hours of vapor extraction from well VE/VW-12.
- On January 7, 1997, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-12 during the sample collection. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-13. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 1 hour of extracting vapors from well VE/VW-13.

- On January 14, 1997, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-13 during the sample collection. The influent vapor PID readings remained at a concentration of 930 ppmv during this time period. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-10. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 2 hours of extracting vapors from well VE/VW-10. The PID reading was approximately 700 to 800 ppmv at the time of sample collection.

- On January 17, 1997, Parsons ES collected SUMMA® canister samples from wells VE/VW-1, VE/VW-2, VE/VW-3, and VE/VW-4 following approximately 2 hours of purging with a 10-standard-cubic-foot-per-minute (scfm) pump. The results of these samples will be used to determine the concentrations of individual compounds and total volatile hydrocarbons (TVH) so that the future operating parameters of the FTO treatment unit can be determined.

- On January 18, 1997, at approximately 9:40 p.m., Mr. Dave Brown (Parson ES Syracuse) received a telephone call from Security Concepts (subcontractor that installed the alarm system on the FTO treatment unit) informing him that the FTO treatment unit had stopped operating. The shutdown was due to a low pressure reading that probably was caused by very cold ambient temperatures (minus 27 degrees Fahrenheit). At low ambient temperatures, the pressure from the propane tank is reduced, resulting in a low-pressure shutdown of the FTO treatment unit.

- On January 21, 1997, Mr. John Mackey traveled to Plattsburgh AFB to assess the cause of the shutdown and to restart the FTO treatment unit. The unit was restarted at approximately 9:35 a.m., and was connected to and began treating vapors from well VE/VW-3.

- On January 22, 1997, at approximately 4:00 a.m., Mr. Dave Brown received a telephone call from Security Concepts informing him that the FTO treatment unit had again stopped operating. The shutdown was due to a Base-wide power outage caused by an ice storm.

- On January 22, 1997, Mr. John Mackey traveled to Plattsburgh AFB to restart the FTO treatment unit. The unit was restarted at approximately 11:35 a.m., and was connected to and resumed treating vapors from well VE/VW-3. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 8 hours of extracting vapors from well VE/VW-3.

- On January 27, 1997, at approximately 3:00 a.m., Mr. Dave Brown received a telephone call from Security Concepts informing him that the FTO treatment unit had stopped operating. On this date, Mr. John Mackey traveled to Plattsburgh AFB to restart the FTO treatment unit. The unit was restarted at approximately 11:30 a.m., and was connected to and began treating vapors from well VE/VW-4.

An influent and effluent SUMMA® canister vapor sample were collected from the FTO treatment unit following approximately 2.5 hours of extracting vapors from well VE/VW-4. The PID reading from the well was 570 ppmv. Mr. Mackey also increased the flow rate of supplemental fuel from the propane tank, which should alleviate the problem of shutdowns associated with low-pressure readings.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
JANUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv)[a]		Destruction Efficiency (percent)	Detected Concentration (ppbv)		Destruction Efficiency (percent)	Influent Sample FT002VW12I2 1/7/97	Detected Concentration (ppbv)		Destruction Efficiency (percent)
	Influent Sample FT002VW9I2 1/3/97	Effluent Sample FT002VW9E1 1/3/97		Influent Sample FT002VW12I1 1/3/97	Effluent Sample FT002VW12E1 1/3/97			Influent Sample FT002VW1311 1/7/97	Effluent Sample FT002VW13E1 1/7/97	
1,2,4-Trimethylbenzene	440	250	43.2	210	150	28.6	2400	240	220	8.3
1,2-Dichlorobenzene	ND[b]	4	NA[c]	ND	ND	NA	ND	ND	ND	NA
1,3,5-Trimethylbenzene	320	100	68.8	200	64	68.0	1600	ND	91	NA
4-Ethyltoluene	240	68	71.7	ND	37	NA	1200	ND	120	NA
Benzene	15	ND	100.0	310	ND	100.0	1200	820	9.8	98.8
Chloromethane	ND	ND	NA	ND	ND	NA	ND	ND	ND	NA
cis-1,2-Dichloroethene	ND	3	NA	7700	70	99.1	16000	81000	830	99.0
cis-1,3-Dichloropropene	230	ND	100.0	ND	ND	NA	ND	ND	ND	NA
Ethyl Benzene	59	6	89.8	ND	12	NA	930	ND	20	NA
Freon 113	ND	ND	NA	ND	ND	NA	ND	1500	ND	100.0
Heptane	220	ND	100.0	4100	23	99.4	18000	3300	46	98.6
Hexane	120	ND	100.0	3900	ND	100.0	15000	2600	ND	100.0
m,p-Xylene	1200	130	89.2	440	94	78.6	6200	340	140	58.8
Methylene Chloride	ND	ND	NA	ND	ND	NA	280	ND	ND	NA
o-Xylene	860	110	87.2	280	81	71.1	4300	360	160	55.6
Tetrachloroethene	17	12	29.4	ND	ND	NA	ND	520	38	92.7
Tetrahydrofuran	ND	ND	NA	ND	ND	NA	ND	ND	ND	NA
Toluene	310	25	91.9	720	42	94.2	6400	2000	120	94.0
Trichloroethene	330	34	89.7	26000	430	98.3	33000	24000	550	97.7
THC[d]	18000	4400	75.6	180000	5100	97.2	580000	490000	26000	94.7

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TABLE 1 (concluded)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
JANUARY 1997
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

			Detected Concentration (ppbv)			Detected Concentration (ppbv)		
Analyte	Influent Sample FT002VW13I2 1/14/97	Influent Sample FT002VW10I1A 1/14/97	Influent Sample FT002VW3I1 1/22/97	Effluent Sample FT002VW3E1 1/22/97	Destruction Efficiency (percent)	Influent Sample FT002VW4I1 1/27/97	Effluent Sample FT002VW4E1 1/27/97	Destruction Efficiency (percent)
1,2,4-Trimethylbenzene	280	750	420	280	33.3	420	250	40.5
1,2-Dichlorobenzene	ND	ND	ND	5	NA	ND	ND	NA
1,3,5-Trimethylbenzene	190	570	260	140	46.2	190	99	47.9
4-Ethyltoluene	270	690	ND	150	NA	220	110	50.0
Benzene	270	560	230	6	97.4	34	ND	100.0
Chloromethane	ND	79	ND	ND	NA	ND	ND	NA
cis-1,2-Dichloroethene	9300	5100	ND	16	NA	ND	ND	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	NA	ND	ND	NA
Ethyl Benzene	470	300	ND	32	NA	120	19	84.2
Freon 113	180	490	ND	ND	NA	ND	ND	NA
Heptane	4700	2400	11000	200	98.2	5900 E[d/]	57	99.0
Hexane	2800	5900	4000	26	99.4	1800	ND	100.0
m,p-Xylene	1600	1200	340	220	35.3	450	100	77.8
Methylene Chloride	ND	ND	ND	ND	NA	21 B[e/]	11 B	47.6
o-Xylene	760	1100	290	190	34.5	150	56	62.7
Tetrachloroethene	300	2200	ND	12	NA	ND	ND	NA
Tetrahydrofuran	ND	ND	ND	ND	NA	ND	ND	NA
Toluene	2600	960	ND	60	NA	37	9	75.7
Trichloroethene	6500	21000	ND	67	NA	43	9.6	77.7
THC[f/]	180000	550000	1200000	24000	98.0	ND	ND	NA

a/ ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See table 2 for field measurements and system operating conditions at the time of sampling.

b/ ND = Not detected.

c/ NA = Not available.

d/ E = value exceeds instrument calibration range, but is within linear range.

e/ B = compound present in laboratory blank and a background substraction was not performed.

f/ THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 2

DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES FROM VENT WELLS VW-1, VW-2, VW-3, VW-4, AND VW-11[a]

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	FT002VW1I1 Detected Concentration (ppbv)[b]	FT002VW2I1 Detected Concentration (ppbv)	FT002VW3I1 Detected Concentration (ppbv)	FT002VW4I1 Detected Concentration (ppbv)	FT002VW11I1 Detected Concentration (ppbv)
cis-1,2-Dichloroethene	ND[c]	38	ND	ND	330
Freon 113	ND	14	ND	ND	1200
Heptane	ND	ND	ND	4500	ND
Hexane	ND	ND	ND	1300	ND
m,p-Xylene	ND	ND	ND	170	ND
Tetrachloroethene	67	14	ND	ND	1500
Tetrahydrofuran	130	140	ND	ND	560
Trichloroethene	ND	1700	ND	ND	13000
THC[d]	400	2000	1100000	210000	21000

[a] SUMMA canister samples collected on January 17, 1997, following approximately 2 hours of purging with a 10-scfm pump.

[b] ppbv = parts per billon volume, as determined by Air Toxics, Folsum, CA using USEPA Method TO-14 GC/MS Full Scan.

[c] ND = Not detected.

[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 3

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0915
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage

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TABLE 3

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sample Date	Sample Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperature (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75	100	75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08	103	69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.
VEW/VW-12	1/7/97, 0855			89.00	93.08											Closed VEW/VW-12
VEW/VW-13	1/7/97, 1505															Opened VEW/VW-13
VEW/VW-13		1/7/97	1600	NA	0.92	96	47.5	52.5	100	2000	9	8.3	950	15.8	4.5	Sample collected
VEW/VW-13		1/14/97	0950	160.91	161.83	108	45.2	54.8	100	930	18.8	2.8	420	19.7	1.3	Sample collected
VEW/VW-13	1/14/97, 1000			0.17	162.00											Closed VEW/VW-13
VEW/VW-10	1/14/97, 1020															Opened VEW/VW-10
VEW/VW-10		1/14/97	1503	NA	4.72	113	71.0	29.0	100	1000	13	6.3	710	15.8	14.3	Sample collected
VEW/VW-10	1/17/97, 2130			77.45	82.17											System shutdown due to weather-related low propane pressure.
-	1/21/97, 1515															System operational, TIC-313 control setpoint changed to 1200deg.F
	1/22/97, 0400															System shutdown at 0400 due to basewide power outage.
	1/22/97, 1634															System operational
VEW/VW-3	1/22/97, 1708															Opened VEW/VW-3
VEW/VW-3		1/22/97	1848	NA	1.67	110	40.9	59.1	100	2200	3.3	12.1	900	14.5	4.8	Sample collected
VEW/VW-3	1/27/97, 0300															System shutdown due to weather-related low propane pressure.
	1/27/97, 1600															System operational
	1/27/97, 1825															Opened VEW/VW-4
VEW/VW-4		1/27/97	2030			94	49.1	50.9	100	570	6.8	8.7	280	14.9	4.3	Sample collected

TABLE 4
HYDROCARBON EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a/] Concentration (ppmv)[b/]	Influent THC[a/] Concentration (µg/L)[c/]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (µg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23	96	100	32	133	0	1.19
12/9/96	VEW/VW-7	3.13	68	283	100	NA[d/]	NA	8	-[e/]
12/9/96	VEW/VW-14	0.06	120	499	100	NA	NA	0	-
12/13/96	VEW/VW-14	3.96	200	831	100	4	15	30	0.14
12/18/96	VEW/VW-8	4.98	690	2,868	100	NA	NA	128	-
12/24/96	VEW/VW-8	0.04	690	2,868	100	9	38	1	0.34
12/27/96	VEW/VW-8	3.23	530	2,203	100	12	50	64	0.45
12/27/96	VEW/VW-9	0.02	20	83	100	NA	NA	0	-
1/3/97	VEW/VW-9	6.83	18	75	100	4	18	5	0.16
1/3/97	VEW/VW-12	0.19	180	748	100	5	21	1	0.19
1/7/97	VEW/VW-12	3.66	580	2,411	100	NA	NA	79	-
1/7/97	VEW/VW-13	0.04	490	2,037	100	26	108	1	0.97
1/14/97	VEW/VW-13	6.75	180	748	100	NA	NA	45	-
1/14/97	VEW/VW-10	0.20	550	2,286	100	NA	NA	4	-
1/22/97	VEW/VW-3	4.42	1,200	4,989	100	24	100	198	0.89
1/27/97	VEW/VW-4	0.08	ND	ND	100	ND	ND	0	-

[a/] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b/] ppmv = parts per million by volume, as determined by the analytical laboratory.

[c/] µg/L = micrograms per liter, as determined by the analytical laboratory.

[d/] NA = not analyzed.

[e/] Effluent samples not collected during sampling event.

File: 728414.04000
Job Files
Analytical Data Rpt.

CC: P. Guest
M. Vessely
D. Downey (FYI)

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax. (303) 831-8208

January 23, 1997

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 4, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2 and 3, which constitute Analytical Data Report No. 4 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the month of December 1996, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The December 1996 data represent the following FTO treatment unit operating conditions:

- On December 4 and 5, 1996, a new variable frequency drive (VFD) was installed, and the FTO unit was placed in the pre-heat mode. The FTO unit was down from November 4, 1996 at 1:24 p.m. through December 6, 1996 at 8:45 a.m.

- On December 6, 1996, the FTO treatment unit was connected to and began treating vapors from well VE/VW-7. Influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit following approximately 1.5 hours of extracting vapors from well VE/VW-7.

- On December 9, 1996, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-7 during the sample collection. The photoionization detector (PID) reading increased from a concentration of 26 parts per million by volume (ppmv) to 260 ppmv during this time period, and the oxygen concentration decreased from 18 percent to 15. 9 percent. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-14. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 1.5 hours of extracting vapors from well VE/VW-14.

- On December 13, 1996, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-14 during the sample collections. Between December 9 and December 13, 1996, the PID reading increased slightly from 320 ppmv to 420 ppmv, and the oxygen concentration increased from 11 percent to 16 percent. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW -8.

- On December 16, 1996, the FTO treatment unit was shut down while an electrical subcontractor (Engler Electric) reconfigured the electrical connections of the FTO unit to enable the blower to be operated with or without the VFD.

- On December 17, 1996, the electrical reconfiguration was completed, the unit was placed in the pre-heat mode, and at 3:30 p.m. the FTO treatment unit was re-connected to and continued treating vapors from well VE/VW-8. The FTO treatment unit was down for 23 hours and 18 minutes.

- On December 18, 1996, an influent SUMMA® canister vapor sample was collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-8 during the time of sample collection. The PID reading was 580 ppmv, and the oxygen concentration was 13.5 percent at the time of sample collection.

- On December 24, 1996, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-8 during the sample collections. The PID reading increased to a concentration of 970 ppmv during this time period. An oxygen concentration measurement was not obtained because the O_2/CO_2 meter was not functioning properly.

- On December 27, 1996, influent and effluent SUMMA® canister vapor samples were collected from the FTO treatment unit, which was extracting and treating vapors from well VE/VW-8 during the sample collections. The PID reading decreased slightly to a concentration of 850 ppmv during this time period. An oxygen concentration measurement was not obtained because the O_2/CO_2 meter was not functioning properly. Following sample collection, the FTO unit was connected to and began treating vapors from well VE/VW-9. An influent SUMMA® canister vapor sample was collected from the FTO treatment unit following approximately 0.5 hour of extracting vapors from well VE/VW-9.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables have been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rich Jasaitis, OHM
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
DECEMBER 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv)[a]		Destruction Efficiency (percent)	Detected Concentration				Destruction Efficiency (percent)
	Influent Sample FT002VW7I1	Effluent Sample FT002VW7E1[b]		Influent Sample FT002VW7I2	Influent Sample FT002VW14I1	Influent Sample FT002VW14I2	Effluent Sample FT002VW14E1	
1,2,4-Trimethylbenzene	320	780	-143.8	960	650	850	180	78.8
1,2-Dichlorobenzene	ND[c]	16	NA[d]	ND	ND	ND	4	NA
1,3,5-Trimethylbenzene	150	350	-133.3	420	ND	640	85	86.7
cis-1,2-Dichloroethene	1300	ND	100.0	2100	980	2500	14	99.4
cis-1,3-Dichloropropene	ND	77	NA	ND	ND	ND	ND	NA
m,p-Xylene	400	640	-60.0	1100	ND	2800	200	92.9
4-Ethyltoluene	ND	390	NA	ND	ND	650	77	88.2
Benzene	ND	11	NA	ND	ND	ND	ND	NA
Ethyl Benzene	ND	27	NA	ND	ND	270	19	93.0
Freon 113	99	ND	100.0	920	3300	840	ND	100.0
Heptane	ND	65	NA	ND	ND	4300	36	99.2
Hexane	ND	ND	NA	ND	ND	ND	ND	NA
o-Xylene	270	530	-96.3	840	500	1700	170	90.0
Propylene	ND	ND	NA	ND	ND	ND	ND	NA
Styrene	ND	ND	NA	ND	ND	ND	46	NA
Tetrachloroethene	2800	550	80.4	2900	370	440	10	97.7
Toluene	160	160	0.0	330	ND	1100	59	94.6
Trichloroethene	16000	1400	91.3	35000	120000	71000	420	99.4
THC[e]	23000	32000	-39.1	68000	120000	200000	3700	98.2

TABLE 1 (concluded)
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
DECEMBER 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Influent Sample FT002VW8I1	Influent Sample FT002VW8I2	Influent Sample FT002VW8I2 D	Effluent Sample FT002VW8E1	Destruction Efficiency (percent)	Detected Concentration Influent Sample FT002VW8I3	Detected Concentration Effluent Sample FT002VW8E2	Destruction Efficiency (percent)	Detected Concentration Influent Sample FT002VW9I1
1,2,4-Trimethylbenzene	640	560	640	260	59.4	410	380	7.3	420
1,2-Dichlorobenzene	ND	ND	ND	4	NA	ND	5	NA	4
1,3,5-Trimethylbenzene	450	490	540	120	77.8	460	170	63.0	250
cis-1,2-Dichloroethene	2300	4100	4200	15	99.6	4200	34	99.2	460
cis-1,3-Dichloropropene	ND	ND	ND	ND	NA	ND	ND	NA	ND
m,p-Xylene	1100	3600	3800	280	92.6	2000	280	86.0	730
4-Ethyltoluene	ND	600	640	110	82.8	ND	120	NA	200
Benzene	170	410	400	4	99.0	320	5	98.4	11
Ethyl Benzene	130	450	460	17	96.3	370	28	92.4	51
Freon 113	ND	ND	ND	ND	NA	ND	ND	NA	7
Heptane	19000	28000	29000	63	99.8	23000	120	99.5	350
Hexane	16000	20000	20000	ND	100.0	16000	24	99.9	220
o-Xylene	730	2000	2100	230	89.0	1000	220	78.0	500
Propylene	ND	ND	ND	ND	NA	ND	ND	NA	81
Styrene	ND	ND	ND	ND	NA	ND	ND	NA	ND
Tetrachloroethene	ND	ND	ND	3	NA	ND	ND	NA	ND
Toluene	360	840	870	69	92.1	ND	3	NA	13
Trichloroethene	190	410	460	51	88.9	370	44	88.1	170
THC[d]	690000	690000	630000	9100	98.6	190	35	81.6	740
						530000	12000	97.7	20000

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See table 2 for field measurements and system operating conditions at the time of sampling.
[b] Parsons ES is having discussions with the field personnel and analytical laboratory to determine if any errors in sample collection and/or analysis may have occurred.
[c] ND = Not detected.
[d] NA = Not available.
[e] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 2

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sampling Date	Sampling Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	8/29/96	9/2/96	1530	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test
VEW\VW-6	9/6/96															System shutdown was identified on Sept 9 due to electrical failure; summa sample not collected
VEW\VW-5	9/19/96															
VEW\VW-5	9/19/96	9/25/96	1435	NA	145:35:00		43.5	56.5	100	2400	10	7.9	1950	16.2	7.9	sample collected
VEW\VW-5	9/30/96															System shutdown identified Sept 30 due to electrical failure
VEW\VW-5	10/2/96															System connected to well VEW/VW-5 and operational at 0900 hours
VEW\VW-5	10/3/96															System shutdown identified Oct 3 due to electrical failure
VEW\VW-5	10/5/96															System connected to well VEW/VW-5 and operational at 1050 hours
VEW\VW-5	10/10/96															System shut down sometime prior to 10/9/96
VEW\VW-5	10/10/96															System connected to VEW/VW-5 at 0913
VEW/VW-5	10/14/96, 1430															Closed VEW/VW-5
VEW/VW-6	10/14/96, 1500															Opened VEW/VW-6
VEW/VW-6		10/14/96	1535	NA	0.58	120	19.1	80.9	100	6800	0	15	1300	14.5	4.9	Sample Collected
VEW/VW-6		10/15/96	845	17.17	17.75	120	17.3	82.7	100	10400	0	21.5	1800	14.2	5.5	Sample Collected
VEW/VW-6		10/16/96	1430	29.75	47.50	120	56.7	43.3	100	6350	0	16	3600	9.5	8	Sample Collected
VEW/VW-6		10/18/96	1535	49.08	96.58	120	67.7	32.3	100	6200	6.6	9.4	4200	12.1	6.1	Sample Collected
VEW/VW-6		10/24/96	945	138.17	234.75	120	56.5	43.5	100	6200	9	7.8	3500	14	5	Sample Collected
VEW/VW-6	11/4/96,1324															System shutdown due to high temp alarm.
VEW/VW-7	12/6/96,0845															System on VEW/VW-7 and operational at 0845
VEW/VW-7		12/6/96	1010	NA	1.42	100	46.2	53.8	100	26	18	3	12	19.5	1.7	Sample Collected
VEW/VW-7		12/9/96	1115	73.08	74.50	100	76.9	23.1	100	260	15.9	3.2	200	17.5	2	Sample Collected
VEW/VW-7	12/9/96,1200				75.25											Closed VEW/VW-9
VEW/VW-14	12/9/96,1212															Opened VEW/VW-14
VEW/VW-14		12/9/96	1340	NA	1.47	108	81.3	18.8	100	320	11	6.5	260	15.5	3.7	Sample Collected
VEW/VW-14		12/13/96	1105	93.42	94.89	108	64.3	35.7	100	420	16	4.1	270	18.7	2.2	Sample Collected
VEW/VW-14	12/13/96,1200				95.81											Closed VEW/VW-14
VEW/VW-8	12/13/96,1208															Opened VEW/VW-8
VEW/VW-8	12/16/96,1612				73.07											System Shutdown
VEW/VW-8	12/17/96,1430															System Restart, @ 1530 p.m. unit connected to well Q22
VEW/VW-8		12/18/96	1130	NA	94.07	117	44.8	55.2	100	580	13.5	4.7	260	16.5	2.9	Sample Collected
VEW/VW-8	12/21/96,1225				165.08											Closed VEW/VW-8 to remove ice blockage

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TABLE 2

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Event Date and Time	Sampling Date	Sampling Time	Time Since Last Sample (hours)	Total Extraction Time (hours)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH Before Dilution (ppmv)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppmv)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
VEW/VW-8	12/24/96,0820															Opened VEW/VW-8
VEW/VW-8		12/24/96	930	NA	166.25	110	53.6	46.4	100	970	NR	NR	520	NR	NR	Sample collected, bad O_2/CO_2 meter
VEW/VW-8	12/24/96,1000				166.75											Closed VEW/VW-8 to switch to manifold from 1000 to 1100
VEW/VW-8		12/27/96	1330	75.00	241.75	101	60.0	40.0	100	850	NR	NR	510	NR	NR	Sample collected
VEW/VW-8	12/27/96,1400				242.25											Closed VEW/VW-8
VEW/VW-9	12/27/96,1500															Opened VEW/VW-9
VEW/VW-9		12/27/96	1530	NA	0.50	101	70.4	29.6	100	135	NR	NR	95	NR	NR	Sample collected
VEW/VW-9		1/3/97	1115	164.25	164.75		75.0	25.0	100	40	21	1	30	21	0.8	Sample collected
VEW/VW-9	1/3/97,1130				165.00											Closed VEW/VW-9
VEW/VW-12	1/3/97, 1150															Opened VEW/VW-12
VEW/VW-12		1/3/97	1555	NA	4.08		69.2	30.8	100	260	15.8	4	180	17.7	2.8	Sample collected.

TABLE 3

HYDROCARBON EMISSIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Extraction Well	Days of Operation	Influent THC[a] Concentration (ppmv)[b]	Influent THC[a] Concentration (μg/L)[c]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (μg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	VEW/VW-6	3.90	5,800	24,111	100	3	12	842	0.10
9/25/96	VEW/VW-5	6.13	3,600	14,966	100	18	75	822	0.67
10/14/96	VEW/VW-6	0.02	3,300	13,719	100	120	499	3	4.47
10/24/96	VEW/VW-6	10.00	6,000	24,943	100	91	378	2,236	3.39
12/6/96	VEW/VW-7	0.08	23,000	95,614	100	32,000	133,028	69	1192.66
12/9/96	VEW/VW-7	3.13	68,000	282,686	100	NA[d]	NA	7,933	-[e]
12/9/96	VEW/VW-10	0.06	120,000	498,857	100	NA	NA	280	-
12/13/96	VEW/VW-10	3.96	200,000	831,428	100	3,700	15,381	29,518	137.90
12/18/96	VEW/VW-8	4.98	690,000	2,868,427	100	NA	NA	128,069	-
12/24/96	VEW/VW-8	0.04	690,000	2,868,427	100	9,100	37,830	1,072	339.16
12/27/96	VEW/VW-8	3.23	530,000	2,203,284	100	1,200	4,989	63,804	44.72
12/27/96	VEW/VW-9	0.02	20,000	83,143	100	NA	NA	15	-

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] ppmv = parts per million by volume, as determined by the analytical laboratory.

[c] μg/L = micrograms per liter, as determined by the analytical laboratory.

[d] NA = not analyzed.

[e] Effluent samples not collected during sampling event.

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File: 728414.04000
Job File
Analytical Data Rpt.

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax. (303) 831-8208

cc: P. Guest
M. Vessely
D. Downey

November 12, 1996

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 3, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1, 2 and 3, which constitute Analytical Data Report No. 3 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during the week of October 14, 1996 and on October 24, 1996, from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO treatment unit was connected to and treating vapors extracted from well VE/VW-6 during the sample collections.

During the week of October 14, 1996, Ms. Kim Makuch (Parsons ES Syracuse) provided oversight during the FTO treatment unit performance tests conducted by Mr. Chris Baer and Mr. Richard Martin (Thermatrix, Inc.). The objective of the tests was to determine the lowest influent oxygen concentration at which the unit can safely operate. They determined that the unit can operate safely at an oxygen concentration of 12 percent, rather than 14 percent at which the unit was previously operating. Ms. Makuch collected four influent and one effluent vapor samples from the FTO treatment unit during this week. The samples were sent to Air Toxics, Ltd. in Folsom, California for analysis by USEPA Method TO-14.

On October 24, 1996, Mr. Dave Brown (Parsons ES Syracuse) collected influent and effluent samples from the FTO treatment unit operating at Site FT-002. Mr. Brown also drained approximately 30 gallons of liquid from the moisture separator. The liquid was discharged to the on-Base groundwater treatment plant for treatment.

Between October 14 and October 18, 1996, the oxygen concentration extracted from well VE/VW-6 increased from 0 percent to 6.5 percent (Table 2). As a result, the flow rate from the well was increased from 34 standard cubic feet per minute (scfm) to 63 scfm.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables have been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest

Peter R. Guest, P.E.
Project Manager

Enclosures

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Rick Jasaitis, OHM
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES
FROM WELL VE\VW-6, OCTOBER 14-OCTOBER 24, 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv) [a]		Destruction	Detected Concentration (ppbv)					Destruction
	Influent Sample FT002VW6I1	Effluent Sample FT002VW6E1	Efficiency (percent)	Influent Sample FT002VW6I2	Influent Sample FT002VW6I3	Influent Sample FT002VW6I4	Influent Sample FT002VW6I5	Effluent Sample FT002VW6E2	Efficiency (percent)
1,1-Dichloroethene	ND[b]	ND	NA[c]	1600	ND	ND	ND	ND	NA
1,2-Dichlorobenzene	ND	42	99.21	1600	ND	ND	ND	15	NA
1,3-Dichlorobenzene	ND	15	99.53	5200	ND	ND	ND	ND	NA
1,4-Dichlorobenzene	ND	37	99.69	5000	ND	ND	ND	16	NA
1,1,1-Trichloroethane	ND	24	99.99	ND	ND	ND	ND	ND	NA
1,2,4-Trimethylbenzene	5300	2900	99.00	5200	6300	6500	6800	980	85.59
1,3,5-Trimethylbenzene	3200	1200	98.65	5000	7300	6900	6700	800	88.06
4-Ethyltoluene	ND	1000	99.41	ND	ND	ND	6900	510	92.61
Acetone	ND	ND	NA	ND	ND	ND	16000	ND	100.00
Benzene	12000	160	98.67	20000	22000	24000	16000	130	99.19
Cyclohexane	290000	1300	90.71	410000	430000	ND	ND	ND	NA
Chlorobenzene	ND	350	NA	ND	ND	ND	ND	ND	NA
cis-1,2-Dichloroethene	230000	2500	98.91	430000	460000	410000	280000	1600	99.43
Ethyl Benzene	ND	250	NA	1700	2000	3100	3300	130	96.06
Heptane	89000	770	99.13	260000	310000	390000	360000	1400	99.61
Hexane	170000	470	99.72	350000	360000	360000	240000	340	99.86
m,p-Xylene	12000	2000	83.33	38000	52000	73000	95000	3100	96.74
o-Xylene	14000	2400	82.86	32000	38000	44000	53000	2400	95.47
Styrene	ND	140	NA	ND	ND	ND	ND	ND	NA
Tetrachloroethene	ND	100	NA	ND	ND	ND	ND	ND	NA
Toluene	22000	1200	94.55	5800	74000	90000	90000	1600	98.22
Trichloroethene	1800	220	87.78	12000	17000	28000	29000	210	99.28
Vinyl Chloride	3000	ND	100.00	4500	2500	ND	ND	ND	NA
THC[d]	3300000	120000	96.36	5500000	5500000	5700000	6000000	91000	98.48

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan. See table 2 for field measurements and system operating conditions at the time of sampling.

[b] ND = Not detected.

[c] NA = Not availible.

[d] THC = Total hydrocarbons referenced to heptane (molecular weight = 100).

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TABLE 2

FIELD MEASUREMENTS AND SYSTEM OPERATING CONDITIONS

FLAMELESS THERMAL OXIDATION DEMONSTRATION

FIRE TRAINING AREA FT-002

PLATTSBURGH AIR FORCE BASE, NEW YORK

Well ID	Vapor Sample Number	Extraction Start Date and Time	Sample Date	Sample Time	System Operating Time Elapsed Prior to Sampling (hours: min)	Total Extraction Time (hours:min)	Blower Air Temperatur (°F)	Flow Rate From Well (scfm)	Flow Rate Of Dilution Air (scfm)	Flow Rate Into Oxidizer (scfm)	TVH* Before Dilution (ppm)	Oxygen Before Dilution (percent)	CO2 Before Dilution (percent)	TVH After Dilution (ppm)	Oxygen After Dilution (percent)	CO2 After Dilution (percent)	Comments
MW-108	FT002-MW-108	8/29/96, 12:15	9/2/96	15:30	NA	93:35	154	67.6	32.4	100		18.9					Bioslurping Pilot Test, samples collected from influent and effluent
VE/VW-6		9/6/96															
VE/VW-5		9/19/96															
VE/VW-5	FT002-VW5	9/19/1996, 11:00	9/25/96			147:07:00				100							Samples collected from influent and effluent
VE/VW-5		9/30/96															System shutdown identified Sept 30 due to electrical failure
VE/VW-5		10/2/96															System connected to well VE/VW-5 and operational
VE/VW-5		10/3/96															System shutdown identified Oct 3 due to electrical failure
VE/VW-5		10/5/96															System connected to well VE/VW-5 and operational
VE/VW-5		10/8/96															09:00-unit acidently shut down by electrical subcontrator
VE/VW-6	FT002-VW6-12	10/14/96; 15:05	10/14/96	15:34	NA	:29	125	34	66	100	6,800	0	15.2	NM	14	15.2	Initiation of well test and Thermatrix O_2 deficiency test. Sample collected from well inlet.
VE/VW-6	FT002-VW6-E2	10/14/96	10/14/96	15:40	:6	:35	125	34	66	100	6,800	0	15.2	NM	14	15.2	Sample collected from stack.
VE/VW-6	FT002-VW6-12	10/14/96	10/15/96	08:45	17:05	17:40	107	33	67	100	10,400	0	21.5	1,800	13	6.2	Sample collected from well inlet.
VE/VW-6	FT002-VW6-13	10/14/96	10/16/96	14:28	29:43	47:23	130	52	48	100	6,350	0	16	3,900	9.8	7.8	Sample collected from well inlet.
VE/VW-6	FT002-VW6-14	10/14/96	10/18/96	15:35	49:07	96:30	120	63	37	100	6,200	6.5	9.4	4,200	12.1	9.5	Sample collected from well inlet.
VE/VW-6	FT002-VW6-E2	10/14/96	10/24/96	09:40	138:04	234:34	NM	61	39	100	6,200	9	8	3,500	14	5	Sample collected from stack.
VE/VW-6	FT002-VW6-15	10/14/96	10/24/96	09:43	:03	234:37	NM	61	39	100	6,200	9	8	3,500	14	5	Sample collected from well inlet.

*TVH = total volatile hydrocarbons measured with direct-reading field instrument

TABLE 3
HYDROCARBON EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Days of Operation	Influent THC[a] Concentration (ppmv)[b]	Influent THC[a] Concentration (µg/L)[c]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (µg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	3.90	5,800	24,111	100.0	2.8	12	842.2	0.10
9/25/96	6.13	3,600	14,966	100.0	18.0	75	821.8	0.67
10/14/96	0.02	3,300	13,719	100.0	120.0	499	2.6	4.47
10/24/96	10.00	6,000	24,943	100.0	91.0	378	2,236.2	3.39

[a] Values given are for total hydrocarbons (THC) referenced to heptane (molecular weight =100).

[b] ppmv = parts per million by volume, as determined by the analytical laboratory.

[c] µg/L = micrograms per liter, as determined by the analytical laboratory.

File: 728414.04000
Job File
Analytical Data Reports

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

CC: D. Downey
P. Guest
M. Vessely

October 18, 1996

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 2, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find enclosed two copies of Tables 1 and 2, which constitute Analytical Data Report No. 2 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected on September 25, 1996 from the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO treatment unit was connected to and treating vapors extracted from well VE/VW-5 at the time of sample collection. For your future reference, a site map also is provided herewith to show the locations of vapor extraction wells and the approximate extent of the total petroleum hydrocarbon (TPH) contamination.

Please note, that tetrahydrofuran was not detected in the influent or effluent samples collected during this sampling event. As you will recall, tetrahydrofuran was reported to be detected at a concentration of 55 parts per billion by volume (ppbv) in the effluent sample collected during the previous sampling event (please refer to Analytical Data Report No. 1, dated October 7, 1996). Therefore, it appears likely that the previously tetrahydrofuran was generated from the incomplete combustion of polyvinyl chloride (PVC) shavings and/or PVC solvent welding compounds temporarily entrained in the Thermatrix FTO unit vapor stream. This inference is consistent with information provided in The MERCK Index (MERCK & Co, Inc., 1983, page 1318), which references the use of tetrahydrofuran as a solvent for high-grade polymers, especially PVC solvents.

Per your request, Parsons ES directed the Air Toxics, Ltd. laboratory to perform natural gas analysis by ASTM Method D-1945 on the vapor samples collected from well VE/VW-5 in order to assess the British thermal unit (BTU) value of volatile organic compounds in the extracted soil gas. The influent sample had a value of 11 BTUs per cubic foot (BTU/ft^3) compared to a value of approximately 12,200 BTU/ft^3 for natural gas in the Plattsburgh area. The natural gas value was obtained via a telephone quote from a representative of the subcontractor providing natural gas for the FTO demonstration.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy of the enclosed data tables and this letter has been provided to AFCEE/ERS on a 3.5-inch diskette in IBM-compatible format. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

for

Peter R. Guest, P.E.
Project Manager

Enclosures: as

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT and diskette only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Brady Baker, AFBCA/OL3A
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

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TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES FROM WELL VE\VW-5, SEPTEMBER 25, 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv) [a] [WFR=67.6 scfm; DFR=32.4 scfm; WO2=18.9%; EO Time=93 hrs 35 min] [b]		Destruction Efficiency (percent)
	Influent Sample	Effluent Sample	
cis-1,2-Dichloroethene	21,000	22	99.90
Benzene	850	ND[c]	100.00
Trichloroethene	49,000	120	99.76
Toluene	44,000	230	99.48
Tetrachloroethene	5,400	34	99.37
Ethyl Benzene	11,000	160	98.55
m,p-Xylene	55,000	940	98.29
o-Xylene	23,000	510	97.78
1,3,5-Trimethylbenzene	7,100	380	94.65
1,2,4-Trimethylbenzene	14,000	1,000	92.86
Hexane	20,000	ND	100.00
4-Ethyltoluene	7,200	340	95.28
Heptane	110,000	130	99.88
TNMHC[d]	3,600,000	18,000	99.50

[a] ppbv = parts per billion by volume, as determined by Air Toxics, Folsom, CA using USEPA Method TO-14 GC/MS Full Scan.

[b] WFR = flow rate from well; scfm = standard cubic feet per minute; DFR = flow rate from dilution air; WO2 = extraction well oxygen concentration; ET Time = system operating time elapsed prior to sampling.

[c] ND = Not detected.

[d] TNMHC = Total non-methane hydrocarbons referenced to heptane (molecular weight = 100).

TABLE 2
HYDROCARBON EMISSIONS
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Days of Operation	Influent THC Concentration (ppmv)[a]	Influent THC Concentration (μg/L)[b]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (μg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96[c]	3.90	5,800	20,736	100.0	2.8	10	724.3	0.09
9/25/96[d]	6.13	3,600	14,966	100.0	18.0	75	821.8	0.67

[a] ppmv = parts per million by volume, as determined by the analytical laboratory.
[b] μg/L = micrograms per liter, as determined by the analytical laboratory.
[c] Values given are for total hydrocarbons referenced to heptane (molecular weight = 86).
[d] Values given are for total non-methane hydrocarbons referenced to heptane (molecular weight = 100).

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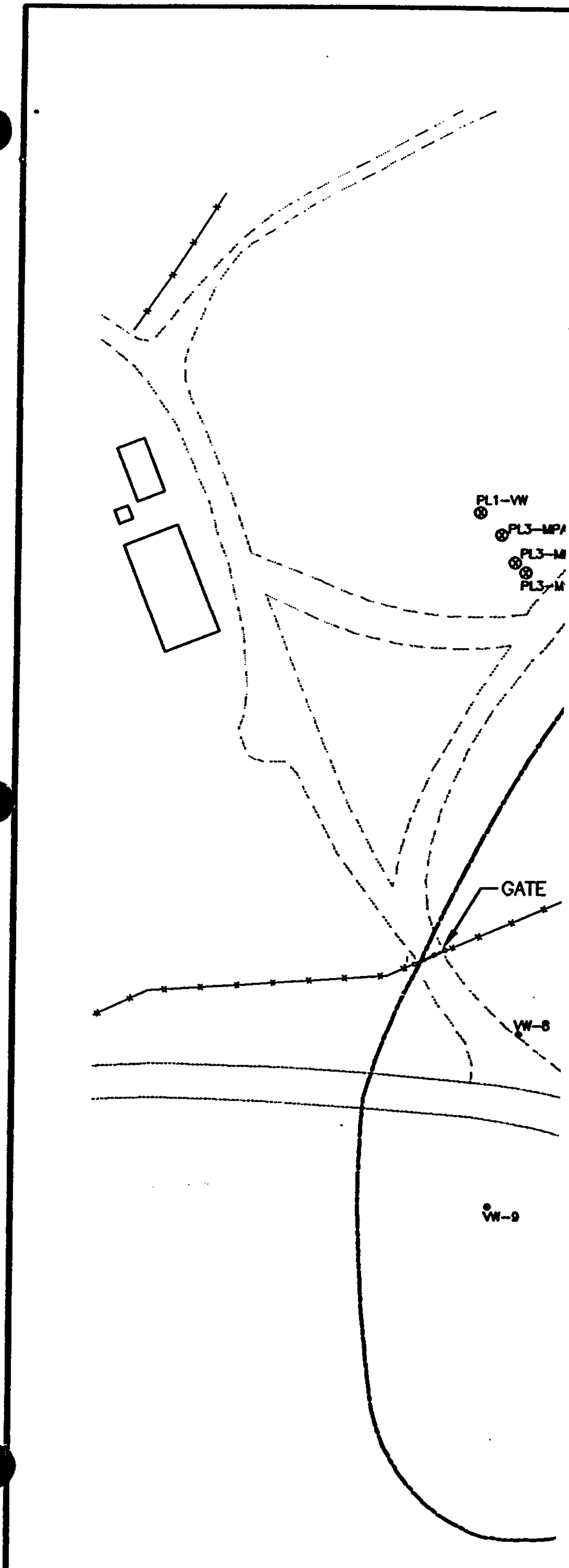

LEGEND

VE/VW-1 ⊙ SVE/BIOVENTING WELL

VW-6 • BIOVENTING WELL

PL3-MPA ⊗ EXISTING MONITORING POINT

MP-1 ○ MONITORING POINT

0 55 110 220
FEET

SITE MAP AND EXTENT OF HYDROCARBONS

FTO Demonstration
Fire Training Area FT-002
Plattsburg Air Force Base, New York

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

K:\AFCEE\728414\PLATTS\96DN0988, 10/18/96 at 10:

File: 728414.04
JobFiles
Analytical Data Report

PARSONS ENGINEERING SCIENCE, INC.

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

cc: P. Guest
M. Vessely
D. Downey

October 7, 1996

Mr. Jim Gonzales
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, Texas 78235-5363

RE: Air Force Contract No. F41624-94-D-8136, Order 02803
Air Conformity Determination of Flameless Thermal Oxidation and Internal Combustion Engine for VOC Off-Gas Abatement
Final Analytical Data Report No. 1, Site FT-002, Plattsburgh AFB CDRL A007A

Dear Mr. Gonzales:

Please find attached two copies of Analytical Data Report No. 1 prepared by Parsons Engineering Science, Inc. (Parsons ES) for the vapor samples collected during startup of the flameless thermal oxidation (FTO) treatment unit operating at Site FT-002, Plattsburgh Air Force Base, New York. The FTO treatment unit was used during the period from August 28 through September 6, 1996 to treat vapors extracted during the bioslurping pilot test conducted by Battelle at well MW108. Tetrahydrofuran was detected at a concentration of 55 parts per billion by volume (ppbv) in the effluent sample. Tetrahydrofuran may be a product of incomplete oxidation, or it may be present in the influent, but at a concentration below the 410 ppbv detection limit. Another possible source of the tetrahydrofuran is that it is being generated from the incomplete combustion of polyvinyl chloride (PVC) shavings and/or PVC solvent welding compounds entrained in the Thermatrix FTO unit. The MERCK Index, (MERCK & Co, Inc., 1983, page 1318) references the use of tetrahydrofuran as a solvent for high polymers, especially PVC solvents. If this is the case, the generation of tetrahydrofuran should be temporary.

Parsons ES contacted the New York State Department of Environmental Conservation (NYSDEC) to determine if their is a regulatory limit for emissions of tetrahydrofuran. NYSDEC does not have a regulatory limit for tetrahydrofuran, however they do have a suggested short-term guideline concentration of 140,000 micrograms per meter cubed ($\mu g/m^3$). 55 ppbv is equivalent to 167.3 $\mu g/m^3$, which is well below the short-term guideline concentration. In summary, the source of the tetrahydrofuran appears to be an academic question at this point and not a regulatory issue. We will continue to monitor for this compound and attempt to locate its origin.

Per Contracts Data Requirements List (CDRL) A007A, one reproducible copy has been provided on a 3.5-inch diskette in IBM compatible format to AFCEE/ERS. If you have additional questions or comments please call me at (303) 764-1919 or Mr. Steve Archabal at (602) 852-9110.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Peter R. Guest.

Peter R. Guest, P.E.
Project Manager

Enclosure

c.c.: Mr. Mark Rounsavill, HSC/PKVD (LOT only)
Mr. Robert Garza, AFCEE/ERS (LOT only)
Mr. Dan Kraft, Booz•Allen, & Hamilton, Inc.
Mr. Steve Archabal, Parsons ES Phoenix
Mr. Dave Brown, Parsons ES Syracuse
Mr. Jeff Dasch, Thermatrix, Inc.
Mr. Rick Brettin, Parsons ES Austin

TABLE 1
DETECTED ANALYTES IN EXTRACTED VAPOR STREAM SAMPLES FROM WELL MW108, SEPTEMBER 2, 1996
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Analyte	Detected Concentration (ppbv) [a/] [WFR=67.6 scfm; DFR=32.4 scfm; WO2=18.9%; EO Time=93 hrs 35 min][b/] Influent Sample	Effluent Sample	Destruction Efficiency (percent)
Chloromethane	< 410	11	NA[c/]
cis-1,2-Dichloroethene	75000	4.3	99.99
Benzene	5100	< 4.1	> 99.92
Trichloroethene	57000	5.6	99.99
Toluene	24000	6.4	99.97
Ethyl Benzene	4000	< 4.1	> 99.90
m,p-Xylene	18000	< 4.1	> 99.98
o-Xylene	5800	< 4.1	> 99.93
1,3,5-Trimethylbenzene	1200	< 4.1	> 99.66
1,2,4-Trimethylbenzene	2900	< 4.1	> 99.86
Hexane	40000	< 16	> 99.96
Heptane	41000	< 16	> 99.96
Acetone	< 1600	20	NA
Tetrahydrofuran	< 1600	55	NA
THC[d/]	5,800,000	2,800	99.95

[a/] ppbv = parts per billion by volume, as determined by Air Toxics LTD., Folsom, CA using EPA Method TO-14 GC/MS Full Scan.

[b/] WFR = flow rate from well; scfm = standard cubic feet per minute; DFR = flow rate from dilution air; WO2 = extraction well oxygen concentration; Elapsed OT = system operating time elapsed prior to sampling.

[c/] NA = Not Applicable.

[d/] THC = Total hydrocarbon referenced to heptane (molecular weight = 86).

TABLE 2
DESTRUCTION EFFICIENCY
FLAMELESS THERMAL OXIDATION DEMONSTRATION
FIRE TRAINING AREA FT-002
PLATTSBURGH AIR FORCE BASE, NEW YORK

Date Sampled	Days of Operation	Influent THC[a] Concentration (ppmv)[b]	Influent THC[a] Concentration (μg/L)[c]	Flow Rate (scfm)	Effluent THC Concentration (ppmv)	Effluent THC Concentration (mg/L)	Pounds of THC Removed	Total Daily THC Emissions (pounds/day)
9/2/96	3.90	5,800	24,111	100.0	2.8	12	842.2	0.10

[a] THC = total hydrocarbon referenced to Heptane (molecular weight = 86).
[b] ppmv = parts per million by volume, as determined by the analytical laboratory.
[c] μg/L = micrograms per liter, as determined by the analytical laboratory.

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APPENDIX C

VENDOR QUOTES FOR VARIOUS VAPOR TREATMENT TECHNOLOGIES

THERM TECH, INC.

THERMAL/CATALYTIC OXIDATION AND MOVING BED ADSORPTION

File 728414.
Subcontractors / Thermatrix
& 728414.04000
Draft Site-Specific Eval. Rpt.
cc: P. Guest & G. [illegible] D. Downey.

Thermatrix Inc.

8335 West Woodard Drive
Lakewood, Colorado 80227
Tel: (303) 989-3793
FAX: (303) 989-3889

101 Metro Drive, Suite 248
San Jose, California 95110
Tel: (408) 453-0490
FAX: (408) 453-0492

May 7, 1997

Mr. Pete Guest, P.E.
Parsons Engineering Science, Inc.
Suite 900
1700 Broadway
Denver, CO 80290

Dear Mr. Guest:

SUBJECT: THERMATRIX PROPOSAL NO. 7127, Rev. 1: Soil Vapor Extraction

Thank you for your interest in Thermatrix flameless oxidation technology and for the opportunity to submit this revised budget proposal for treating the vent stream from a soil vapor extraction (SVE) process.

Budget Price:

The oxidizer recommended for your application is a recuperative GR model rated for 500 SCFM. The budget price for this System is $200,000.

The proposed System includes the following: oxidizer, preheater, PLC and panel, fume mixer and train, fuel gas train, dilution air blower and train, stack, piping and instrumentation.

The prices do not include any applicable import, export, excise, sales, use or value-added taxes. It does not include spare parts, freight, handling, site preparation, foundations, installation, commissioning or performance testing. These parts and services are available for turnkey systems.

Delivery:

Typical delivery of oxidizer systems, FOB point of manufacture, is 22 to 24 weeks after acceptance of a valid purchase order, allowing 4 to 6 weeks for development of engineering drawings and documents and 2 weeks for approval by buyer. An additional cost for expedited delivery can be provided with a firm-price quotation at the request of the buyer.

Performance and Guarantee:

Thermatrix guarantees oxidizer performance at 99.99% VOC destruction or 1 ppmv total VOC in the oxidizer exhaust, whichever is least restrictive. Though not guaranteed, typical thermal NO_x emissions are 2 ppmv, and CO is less than 10 ppmv.

Design Basis:

The SVE vent is air containing 1,026 ppmv VOC (including 53 ppmv halogenated compounds) at a flowrate of 500 CFM at 77°F and 100% relative humidity.

Dilution air is not required during normal operation of the oxidizer, but is required for startup. Supplemental fuel gas is required to maintain normal operating temperature in the oxidizer.

Utility Requirements:

Based on 8760 annual operating hours, the estimated operating costs for the application described above would include:

CASE/MODEL	UTILITY COST ESTIMATE			
	Electrical Power ($0.05/KWH)		Supplemental Fuel Gas ($3.00 per 10^6 Btu)	
GR	3 Hp/3KW	$1.5K/yr	0.2 x 10^6 Btu/hr	$5K/yr
Power consumption is based on air and/or fume blower motor power requirements plus 1.2 KW control and instrument power. A fume blower, if required, can be provided as an option.				

Clarifications:

It is assumed that the SVE vent has a minimum of 13%vol. oxygen. If the actual oxygen content is lower, then the extraction rate may need to be reduced and supplemental air added in the feed to the oxidizer.

Thermatrix has designed the GR model's recuperative exchanger for long life and minimal maintenance. The tubes are fixed at the cooler inlet and are free-floating at the hot end. Additionally, the inlet has three inches of castable refractory insulation above the weld, shielding the weld from the 650°F exhaust temperature. The tube-to-tubesheet weld sees little thermal stress in either continuous or cyclical service; the minimized stress allows for long service life in this robust exchanger design.

The oxidizer exhaust contains HCl which may require abatement depending upon local regulatory requirements.

Various grades of corrosion resistant materials of construction in the oxidizer can be provided as an option depending on customer requirements. The base budget price for the proposed system does not include an allowance for material upgrades due to the concentration of HCl. The prices of acid-resistant materials are subject to market demand and are adjusted to market conditions at the submission of a firm-price quote or acceptance of the purchase order.

Per your request, also included is a budgetary proposal for a Thermatrix Moving Bed Adsorption System (MB-500). As we have discussed, Thermatrix has re-designed the adsorption and desorption components of the PADRE® system. The resulting "moving bed" system decouples the adsorption and desorption process where before both of these process occurred in a single, resin packed adsorption bed. The system has been designed to combine the higher removal efficiency of a packed bed adsorber with the cost benefits of a continuously desorbing system. In this new system, a solid packed bed of adsorbent slowly moves down through the adsorbing section into a separate desorbing section. This provides the high removal rates that are obtainable with a packed bed while moving the desorption process out of the adsorber. I look forward to meeting with you in the near future to discuss our new design in detail.

We trust you will find this information useful and appreciate your interest in Thermatrix technologies. We look forward to working with you on this application and also others in the future. If you have any questions or if we can provide further information, please contact me at the Colorado sales office at (303) 989-3793.

Sincerely,

Richard Scheig
Sales Director

cc: John Clark, Thermatrix Inc.
Bill Binder, Thermatrix Inc.

THERMATRIX BUDGET-PRICE PROPOSAL

Moving Bed Adsorption System MB-500

To: Pete Guest, P.E.
Consultant: Parsons Engineering Science
Address: Denver, CO
Telephone: (303) 831-8100
Fax: (303) 831-8208

Project Ref: SVE
Proposal No: 7127

Design Criteria

Application:		SVE
Major Constituent(s):		Hexane, TCE, DCE, F113
Estimated Initial Recovery Rate:	5,010	lb/month
Maximum Air Concentration:	1,026	ppmV
Maximum Air Flow Rate:	500	scfm
Maximum VOC Loading:	6.86	lb/hr
Maximum Influent Air Temperature:	30.0	
Maximum Water Vapor Loading:	50.0	%*(No Entrained Liquids Allowed)*
Treatment Goal:	95	%

Capital Costs

TMX MB-500 Moving Bed Adsorption System *System consists of: Adsorber, Desorber, Service Module, R&H Ambersorb 600 Resin*	$210,000
Setup Charge: *Includes - 5 days of start-up, interconnect of modules, and operator training.*	$8,000
Purchase Price: *(not included: applicable taxes and freight FOB factory)*	**$218,000**

Estimated Utility Costs

	Average Requirement	Ave. $ Cost / Hr.	$ Cost / Lb Recovered
Electricity (480V,3ph, 60Hz)	30.0 kW-hr.	$1.50	$0.22
Total Unit Operating Costs:		$1.50	$0.22

Assumptions

1) Electrical costs based upon utility rate of: 0.05 *$ per kWh*
2) Operating Basis: 730 *Hrs per month*
3) 2 SCFM compressed air required

Warranty

Thermatrix warrants that the equipment will be free from defects in workmanship and materials for the period ending: twelve (12) months from date of operation, or fourteen (14) months from the date of shipment to the buyer. Thermatrix's sole liability and Buyer's sole remedy under this warranty will be limited, at Thermatrix's option, to repair or replace the parts which may fail during the warranty period because of a defect in workmanship or material. This warranty does not extend to equipment or parts that have been subject to misuse, abuse, improper application, alteration, corrosion, erosion, improper storage, accident, negligence or incorrect repair or service not performed or authorized by Thermatrix Inc.

This pricing is to be used only for the purposes of estimating the cost of a system. Firm prices require a final quotation authorized by a Thermatrix Engineer.

Date: 5/7/97
Thermatrix Contact: Richard Scheig
Telephone: 303-989-3793

Valid for: Budgetary

E PRODUCTS INC.

THERMAL OXIDIZER

E Products, Inc.
Environmental Products & Services

May 7, 1997

Mr. Gerald Cyr
Parsons Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

Re: Thermal Oxidizer Evaluation and Quotation Proposal 4573.1

Dear Mr. Cyr:

Environmental Products, Inc. (EPI) is pleased to present the following proposal to Parsons Engineering Science for a Venturi-500 Thermal Oxidizer. We have thoroughly evaluated the process requirements for your soil remediation site as per your inquiry of April 22, 1997 and believe that we can supply the most efficient, economical, and effective system available. A thermal oxidizer is recommended as opposed to a flare since a thermal oxidizer can handle a wider range of concentrations of contaminants. A thermal oxidizer can be later modified to accommodate energy recovery equipment such as a heat exchanger or catalyst at a later time an enclosed ground flare can not. This proposal will cover the thermal oxidizer and related equipment.

The E Products, Inc. Venturi Thermal Oxidizer advantages include:

- Uses the fume stream as the fuel source which lowers clean up time and fuel costs
- Controlled by temperature not LEL, so there is not a need for a LEL analyzer which needs to be calibrated
- Monolithically casted refractory of 4.5 inches for durability and skin temperature
- Uses ceramic, venturi shape burner tile which eliminates the possibility of flashback and increases burner life
- One year "no excuses" warranty included with purchase or rental
- Flame arrestor, strip chart recorder, skid, and exhaust stack are included in price

It is understood that the site parameters are as follows:

Flow:	500 scfm maximum
Temperature:	70 F
Composition:	THC and other compounds

4390 McMenemy Street • St. Paul, Minnesota 55127-6004 • Phone (612) 490-9690 • Fax (612) 490-9840 • E-Mail epi@minn.net

To eliminate hydrocarbons in a vapor stream with a destruction rate effectiveness up to 99.99% and No_x emissions below 100 ppm, we recommend an EPI thermal oxidizer with our exclusive ceramic Venturi-Jet high-efficiency burner. The venturi jet burner design can accept concentrations which range from 0% of LEL to over 100% of LEL. This arrangement uses the heating value of the fume stream as a fuel source. The burner can destroy up to 73 pounds per hour of VOCs. A fuel consumption chart for estimating the cost of auxiliary fuel has been included. The oxidizer will also include our fume mixing chamber, auxiliary fuel supply piping, forced draft combustion air fan, and easy to operate process controls. A catalyst is offered as optional equipment.

The thermal oxidizer will operate at a minimum of 1,400° F with a residence time of 0.5 second. The process operating temperature will be controlled by a digital temperature controller receiving signal from a type "K" thermocouple for temperature sensing. The burner controller contains a first out annunciator with contacts to assist in operation.

Equipment Specifications for a Venturi-500 Thermal Oxidizer

1. <u>High-efficiency burner whose features include:</u>

- **Ceramic Venturi-Jet Tile** -- Design accelerates flow through the burner, thereby eliminating the possibility of flashback. The burner is a cast and fired ceramic material which will not break down or erode from harsh chemicals because of this unique choice of material.

- **Windbox** -- Controls the ratio of combustion air brought through and around the ignition tube which regulates the air/fuel ration. The windbox is manually adjustable.

- **Ignition Tube** -- Contains the flame to produce a higher destruction efficiency and reduce production of NO_x and CO. The ignition tube is lined with a low specific heat castable refractory.

  This unique burner design uses the fume stream's oxygen and heating value which reduces makeup air and supplemental fuel consumption, with up to 30% savings in operation costs.

2. <u>Forced air combustion fan:</u>

The fan, which operates when there is not enough oxygen present in the fume stream, supplies supplemental air into the combustion chamber. The placement of the fan before the combustion chamber allows more precise control of supplemental air, easier cold start up, and smooth, stable temperature during rapid changes in fume BTU value.

3. **Cylindrical-casted combustion chamber:**

The chamber is cylindrical to eliminate dead air spots, add structural strength, increase the mixing effect of fumes with the auxiliary fuel and combustion air. The cylindrical design also allows for a monolithically cast liner which eliminates hot spots and increases refractory life. A low specific heat, lightweight insulation is used for its excellent durability, low erosion factor and high insulating value. Test ports will be placed strategically for sampling for regulatory requirements.

4. **Cylindrical-shaped inlet chamber:**

The inlet section is cylindrically shaped to mix the combustion air with the high LEL fume stream. The combustion air fan is attached to the chamber in an arrangement that reduces the air packing to a certain side. The inlet chamber can be externally insulated to help eliminate condensation.

5. **Control panel:**

U.L. Listed Panel, NEMA 4 enclosure houses a programmable burner process controller with flame strength indicator, high temperature limit controller with temperature read out, programmable temperature controller with digital read-out, strip chart recorder, purge timer, alarm silencing switch, operating lights to show normal operation, starter push-button, gas pilot ignition push-button system, ignition transformer, fan motor starter, motor load fuses, step-down transformer, if required, thermal strips, and control circuit fuses.

6. **Factory mutual equivalent natural gas or propane piping train:**

Includes safety shutoff valve, automatic gas flow control valve, high and low gas pressure switches, pressure gauge, manual isolating valves, pilot gas regulator, pilot solenoid shutoff valve and pressure taps. All interconnecting piping mounted on the unit will be supplied, and all control items will be fully wired.

7. **Fume piping train:**

Includes a safety shutoff valve, flame arrester, pressure gauges, and low pressure switch.

8. **Discharge stack:**

A discharge dilution stack 14 feet from equipment grade. Stack will be made of mild steel and can be removed for shipping. The design will be as such as a rain cap will not be required. Stack will be painted with a high temperature enamel.

Installation:

The following items are *not* covered in this quotation but can be supplied by EPI:

1. Suitable structural support for the thermal oxidizer.

2. Connection of all utilities to the thermal oxidizer system terminal points, including 110 or 230 volt, single phase or three phase, 60 hz power and regulated pressure natural gas or propane at 5 PSIG.

3. Piping or ducting to the thermal oxidizer.

4. Any permits, such as air pollution control approvals, building permits, or any other regulatory documents which may be required.

5. All testing required for regulatory permits.

6. Installation, field erection and start up of the thermal oxidizer.

The thermal oxidizer will be built and tested at our manufacturing facility. After testing is finished, the thermal oxidizer will be disassembled only as necessary for shipment.

Drawings and Manuals:

Three (3) sets of Maintenance/Operating Manuals will be provided and will include the following: Spare parts list, service instructions, major component bulletins, general arrangement drawings, process drawings, electrical schematics, piping and instrumentation drawings, troubleshooting instructions, maintenance and operating instructions, and installation instructions.

Delivery:

An effort is made to stock standard thermal oxidizer systems. If an "off the shelf" unit is not available the following is a standard manufacturing process: approval drawings that include equipment layout, a process diagram, piping and instrumentation schematic, and an electrical schematic can be submitted to you no later than two (2) weeks after receipt and acceptance of your purchase order and first payment. Testing can take place eight (8) weeks after receipt of returned submittal drawings and shipment can take place two (2) weeks after testing.

Pricing:

Purchase of Venturi 500 Thermal Oxidizer	**$39,361.00**
Rental per month of Venturi 500 Thermal Oxidizer	**$3,970.00**

Options:

Catalytic Modular Insert - Platinum cell, low pressure drop design.	**$6,203.00**
Remote Monitoring Equipment.	**$3,750.00**
Shipping	**$1,500.00**
Start Up and Training	**$2,500.00**

Payment Terms:

Payment terms are as follows: Thirty (30) % due with purchase order, Twenty (30) % due submittal of approval drawings, Thirty (30) % due upon readiness to ship, and Twenty (20)% Net 30.

Rental terms are as follows: First and Last months payments are due before shipment. Monthly rental payments are due the 1st of each month. Fifty (50) % of the rental payments can be applied to the purchase of this system. The system if rented must be returned in reasonable condition. Any repairs necessary to the equipment will be billed on a time and material basis.

Taxes and permit charges are not included in the pricing. These prices are valid for sixty (60) days. Equipment to ship F.O.B. our dock in Vadnais Heights, MN.

Guarantee:

EPI will guarantee a minimum of 99% destruction of hydrocarbons based on measurements taken at the inlet and outlet of the thermal oxidizer system. This guarantee is based on a minimum hydrocarbon concentration of 1,000 ppmv taken at the inlet of the oxidizer. NOx emissions will not exceed 50 ppmv. CO emissions will not exceed 100 ppmv. This guarantee does not include the cost of an air pollution compliance test.

The thermal oxidizer and related components supplied by E Products, Inc. comes with a complete one year warranty. The equipment is guaranteed for defects in workmanship for one year from the date of delivery of the equipment. For further details regarding the product warranty see the enclosed "Standard Terms of Sale and Warranty".

The information provided in this proposal contains proprietary information about EPI equipment design and operation. All information is to be held confidentially and not disclosed in any way to other individuals or organizations to whom this proposal is not related.

E Products, Inc. reserves the right to modify or change the proposed design in an effort to provide a system which is equivalent or better.

EPI thanks Parsons Engineering Science for the opportunity to propose this system and eagerly awaits your response. If you have any questions or concerns, please feel free to contact us at (612) 490-9690 or by e mail at epi@minn.net.

Sincerely,

E PRODUCTS, INC.

Stephen M. Hirt
Director of Products

Enclosures: Engineering Specifications, Standard Terms od Sale and Warranty

Thermal Oxidizer Evaluation and Quotation 4573

This agreement made between:

E Products, Inc.
4390 McMenemy Road
Vadnais Heights, Minnesota 55127

______________________________ Date: ____________

Stephen M. Hirt
Director of Operations

and

Mr. Gerald Cyr
Parsons Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

______________________________ Date: ____________

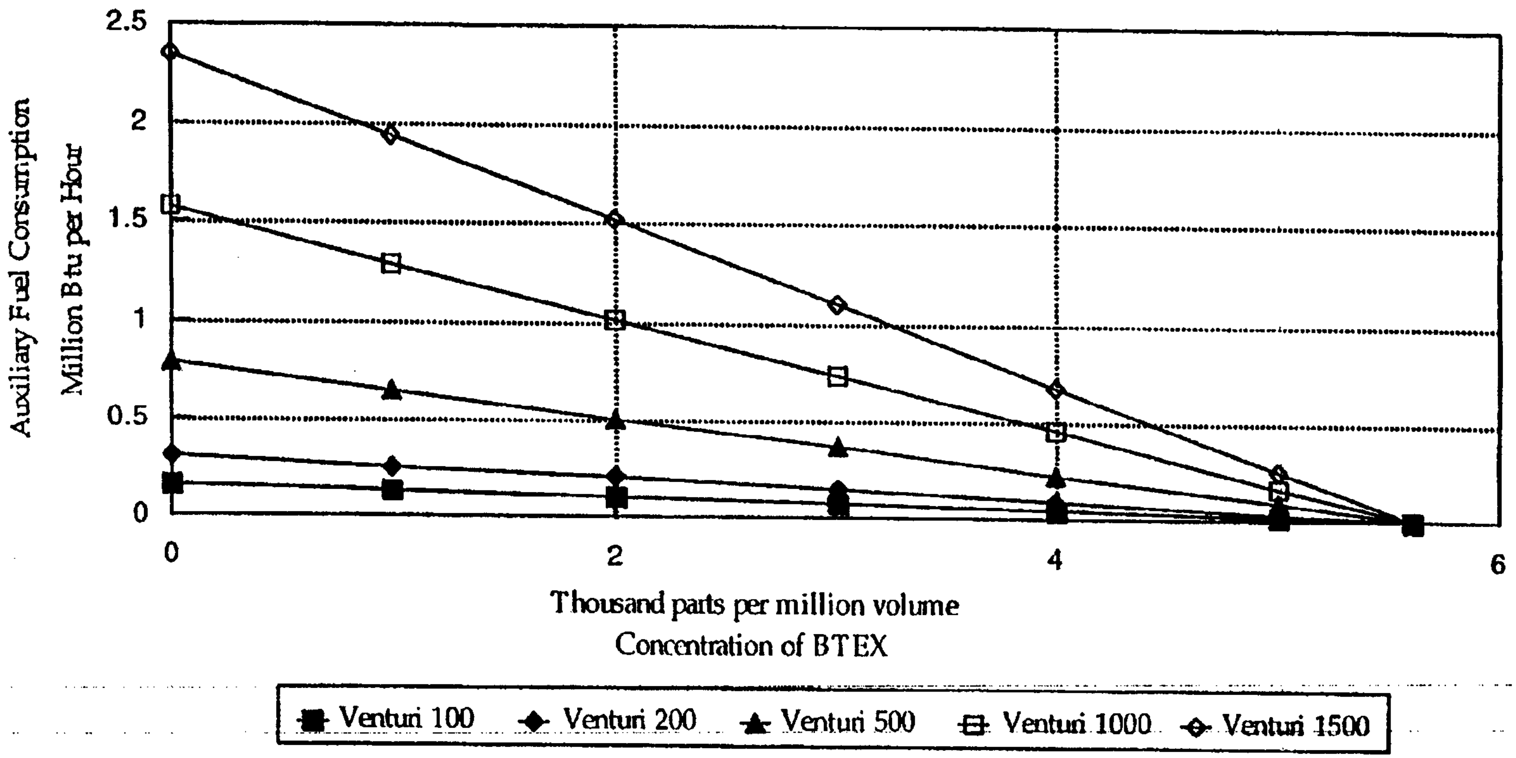
Title: ______________________________

Please return a signed copy of this proposal with first payment to EPI as Authorization to proceed.

EP Products, Inc.
Environmental Remediation Products & Services
4390 McMenemy Road
Vadnais Heights, Minnesota 55127
Phone (612) 490-9690
Fax (612) 490-9840
Minnesota • Illinois • Iowa • Wisconsin

THERMAL OXIDIZER

AUXILIARY FUEL CONSUMPTION



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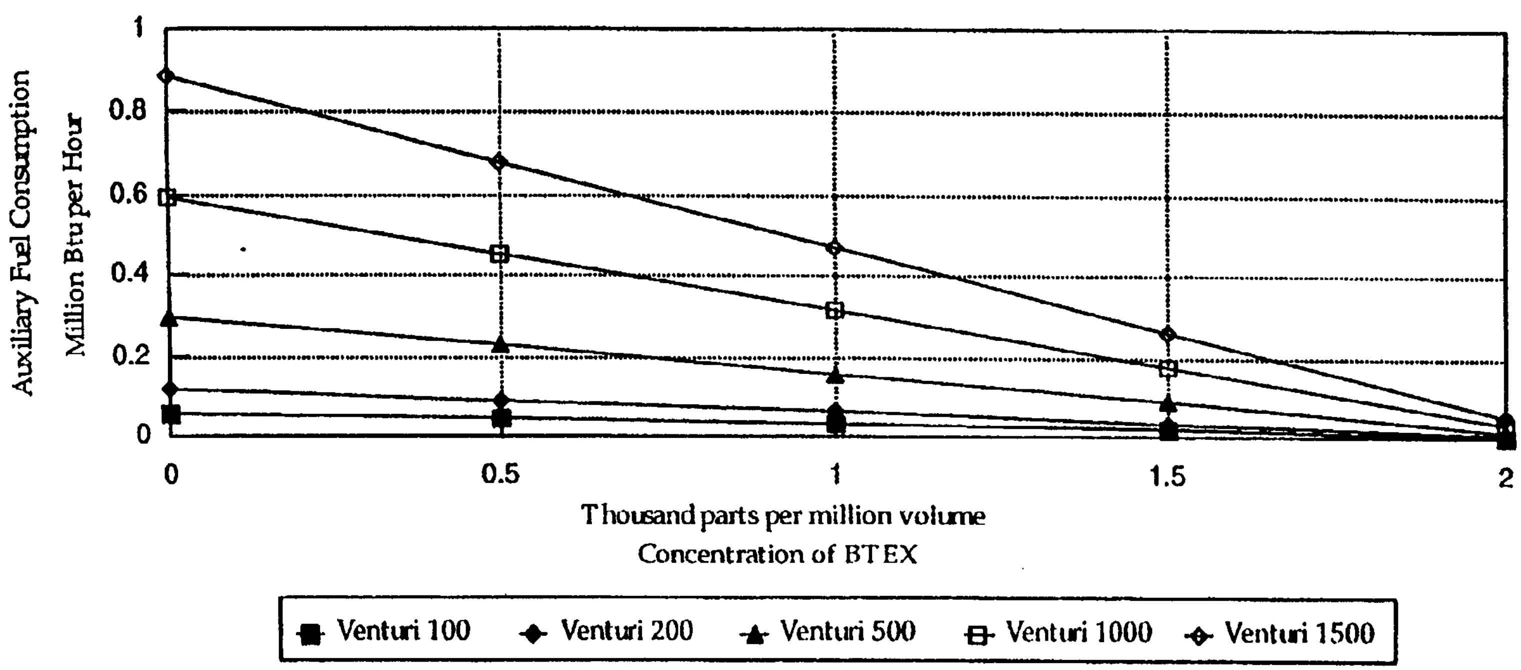
Minnesota • Illinois • Iowa • Wisconsin

CATALYTIC OXIDIZER

AUXILIARY FUEL CONSUMPTION



Maximum 2100 ppmv BTEX without dilution.

THERM TECH, INC.

THERMAL/CATALYTIC OXIDATION

THERMTECH, INC.

$AFE • SIMPLE • ECONOMICAL

May 7, 1997

Gerald Cyr
Parsons Engineering
1700 Broadway, Suite 900
Denver, CO 80290
Phone (303) 764 - 1918 Fax (303) 831 - 8208

SUBJECT: THERMAL/CATALYTIC OXIDATION EQUIPMENT
PROPOSAL NO. BS97A84

Dear Mr. Cyr :

ThermTech, Inc. welcomes this opportunity to submit the enclosed proposal for your consideration. We have prepared this proposal in accordance with our understanding of your application. The specification and design criteria of the system we are recommending is outlined and discussed on the following pages.

ThermTech, Inc. has been providing quality products and engineered pollution control systems to the process industry for the past ten years. We design, engineer, and manufacture Thermal and Catalytic Oxidizers with capacities ranging from 100 SCFM to 30,000 SCFM.

We are proud of the reputation our equipment has earned for reliable performance. We are committed to helping industry meet or exceed environmental standards in an economical manner. We think that, once you have considered our equipments versatility, quality of construction, ease of maintenance, and simplicity of operation, you will feel confident that ThermTech, Inc. should be your vendor of choice.

This proposal incorporates the following:

I - Pricing and Options
II - Design Criteria
III - Term and Conditions

We appreciate your interest in our products and thank you for your time and consideration. If this proposal meets with your approval, please sign and return a duplicate copy with required approvals.

Sincerely,

Brian Smith, Sales

BS / emj

Accepted and agreed to by:

Company name

By:
Title:

PROPOSAL NO. BS97A84
May 7, 1997
Section I Page 1

PRICING AND OPTIONS

VAC 50CL	Thermal oxidizer with the capability to be converted to catalytic operation.	$27,500.00

- skid mounted, UL Type 4 control panel, flame arrestor start-up and shutdown purge valve.

OPTIONS:

CATALYTIC CONVERSION PACKAGE (90%)	$25,300.00
HEAT EXCHANGER (CL)	$21,800.00
5 FOOT STACK EXTENSION	$ 1,200.00

All pricing is quoted F.O.B. our plant, Kingwood, Texas. Prepaid freight is billed at cost plus 10% handling.

Any present of future duty, sales, use excise or other taxes whether Federal, State or Local are not included in prices stated herein and when due shall be paid by the Purchaser without cost or charge to ThermTech, Inc.

Prices will be held firm for thirty days from the date of this proposal.

TERMS:
30% with order
30% upon receipt of ordered parts
30% upon completion/prior to shipment
10% net 30 days

DELIVERY:

Shipment can be made in 8 to 12 weeks after receipt of a valid purchase order, progressive payments and all required approvals.

STARTUP:

We will supply an engineer for startup and training of your operating personnel as required at a charge of $75.00 per hour ($600.00 minimum), portal to portal plus travel expenses. Per diem will be invoiced at $30.00 per day. Airfare, hotel and rental car expenses will be invoiced at cost plus 10%.

WARRANTY:

We warrant our equipment shall be free of defects in material and workmanship for a period of one (1) year from the date of purchase. With regard to components we have purchased and installed on the equipment, the manufacturer of that equipment's expressed warranty will apply. Freight (express, ground, etc.), duties or taxes are the customer's responsibility and will not be prepaid by ThermTech. This warranty is void if the equipment is operated beyond its design limitations or is modified in any way without the written permission of the manufacturer.

DRAWINGS:

P & ID and general arrangement drawing will be available for your approval two (2) to four (4) weeks after receipt of order and progressive payments. The general arrangement drawing's dimensions must remain subject to change upon ThermTech's receipt of as built, purchased components; however, every effort has been made in developing the general arrangement drawing submitted for your evaluation to allow for the largest expected dimensions of purchased components.

Electrical drawings will be provided in the operation and maintenance manual which will ship with the unit upon completion of fabrication and test fire.

PROPOSAL NO. BS97A84
May 7, 1997
Section II Page 1

DESIGN CRITERIA

BASE OXIDIZER

1. volume rating — 500 SCFM
2. process stream temperature — 100 °F
3. process stream content
   see attached for chemical analysis of solvent
4. operating temperature — 1410 °F
5. residence time — 1.0 seconds

HEAT EXCHANGER

1. outlet temperature — 700 °F
2. xx shell & tube, ____ plate

CATALYTIC CONVERSION MODULE

1. inlet temperature — 750 °F
2. outlet temperature — 1000 °F
3. xx precious metal, ____ plate

BURNER

1. manufacturer — Eclipse
2. installed capacity — 1,500,000 BTU/Hr

DESTRUCTION EFFICIENCY

1. thermally — 95% Minimum
2. catalytically — 90% Minimum

PROCESS BLOWER - to be supplied by others

PROPOSAL NO. BS97A84
May 7, 1997
Section II Page 2

GAS TRAIN

1. _____IRI, __xx__FM

BURNER MANAGEMENT SYSTEM

1. manufacturer — ECLIPSE -- DUNGS
2. ____P L C, __xx__hard wire relay

POWER REQUIREMENTS

1. 230/460 V/ 3 ø / 60 Hz

OXIDIZER WEIGHT

1. thermal system	2100 Lbs
2. catalytic system	300 Lbs
3. heat exchanger	1200 Lbs
4. support system	300 Lbs
5. estimated total	3900 Lbs

FOOT PRINTS (ESTIMATE)

1. Skid (base oxidizer) 5 ' 7 " W x 11 ' 4 " L

PROPOSAL NO. BS97A84
May 7, 1997
Section II Page 3

PROCESS STREAM ANALYSIS

1. Hydrocarbons ___11,200___ PPMV

(52 PPMV of chlorinated hydrocarbons)

ESTIMATED OPERATING COSTS AT 500 SCFM

1. Operating thermally with no input from the above process stream

___1.15 MM___ BTU/HR

2. Operating thermally with a heat exchanger and no input from the above process stream

___.54 MM___ BTU/HR

4. Operating catalytically with or without input from the above process stream

___.45 MM___ BTU/HR

5. Operating catalytically with a heat exchanger and full input from the above process

___.16 MM___ BTU/HR

PROPOSAL NO. BS97A84
May 7, 1997
Section III Page 1

GENERAL TERMS AND CONDITIONS

1. **ACCEPTANCE**
These General Terms and Conditions constitute the Agreement between ThermTech, Inc. (Hereinafter called "Company") and the firm to whom the above referenced proposal is made (hereinafter called "Buyer") for the supply of the equipment and machinery (hereinafter called "Equipment").

2. **TAXES** - Any present or future duty, sales, use, excise or other taxes whether Federal, State or Local, applicable to this transaction are not included in price herein stated and when due shall be paid by the Purchaser without cost or charge to the Company.

3. **CANCELLATION** - Any contract and orders resulting from this proposal shall be binding on the parties and cancellation, recision, suspension or modifications will be accepted only upon terms that will indemnify ThermTech, Inc. against all losses and damages and provide a pro-rata increment of profit.

4. **RISK OF LOSS TO EQUIPMENT** - The responsibility of this Company as to damage to Equipment in transit ceases upon delivery of Equipment in good order to common carrier at point of shipment. Purchaser agrees to accurately check the shipment when it arrives at destination and to file immediate claim within ten (10) days with local carrier agent for any shortages or damage and to immediately so advise this Company in writing. No material is to be returned to this Company for any reason without this Company's written permission.

5. **CHANGES** - No change in an order shall have any force, effect or validity whatsoever except with this Company's written consent and under conditions which will indemnify this Company for costs of such changes. Detailed descriptions of changes must be submitted by the Purchaser in writing.

6. **TOLERANCES** - Unless otherwise stated, commercial tolerances, usually applicable to the product, shall apply.

7. **EXCUSABLE DELAYS** - Original agreed upon times are not to be deemed of the essence of an accepted order and reasonable variations from originally agreed upon times will be accepted by buyer. This Company shall not be liable in any way for any delay due to strikes, differences with workmen, accidents to the machinery, delays of carriers, fires, acts of God or public enemy or other causes of delay beyond its control. If the buyer delays shipment, payments are to be made as though shipment had been made as specified and the equipment shall be at buyer's risk and subject to reasonable storage charges. The original delivery date will also be directly extended by any delays due to awaiting drawing approval, temporary work suspension requests or changes by the buyer.

8. **TITLE TO EQUIPMENT** - Title to equipment shall remain with this Company until full payment has been made, regardless of the mode of attachment of said equipment to the real estate or otherwise. Upon failure to make payments or any of them, as herein specified the Company may retain any and all partial payments which may have been made, as liquidated damages, and shall be free to exercise such other rights as the law permits.

9. **REFUSAL TO ACCEPT DELIVERY** - Accepted orders are for shipment as soon as manufactured and are not subject to suspension or to deferred shipments, except with this Company's written consent upon terms which will indemnify it for all loss or damages arising therefrom.

PROPOSAL NO. BS97A84
May 7, 1997
Section III Page 2

10. **PATENT LIABILITY** - The buyer assumes and will bear the expense of, and will hold this Company harmless against, any suit, claim or damage arising from or out of any patent liability for goods manufactured to buyer's design or specification or specially designed by this Company to meet buyer's requirements or for actual or alleged infringement of any U.S. or foreign patents because of use of equipment in buyer's installation.

11. **LIMITED WARRANTY** - We warrant our equipment shall be free of defects in material and workmanship for a period of one (1) year from the date of purchase. With regard to the components we have purchased and installed on the equipment, the manufacturer of the equipment's expressed warranty will apply. Freight (express, ground, etc.), duties or taxes are the customer's responsibility and will not be prepaid by ThermTech. This warranty is void if the equipment is operated beyond its designed limitations or is modified in any way without the written permission of the manufacturer.

12. **LIMITATION OF LIABILITY** - Within ten days after receipt of shipment, Purchaser shall examine such equipment for any damage, defects or shortage. All claims, including for alleged damaged or defective goods, shortage or non-deliverance of goods, negligence of any other cause whatsoever, shall be deemed waived unless made in writing and received by this Company within ten (10) days after Purchaser's receipt of goods. Failure of Purchaser to give notice of any claim within such time period shall be deemed absolute and unconditional waiver of such claim irrespective of whether the facts giving rise to such claim shall have been discovered or whether processing, use or resale of the material shall have taken place. This Company's determination of the validity of any claimed defect shall be conclusive and binding on Purchaser. **PURCHASER'S EXCLUSIVE REMEDY SHALL BE FOR DAMAGES AND THIS COMPANY'S LIABILITY FOR ANY AND ALL LOSSES OR DAMAGES RESULTING FROM ANY CAUSE WHATSOEVER, INCLUDING ALLEGED NEGLIGENCE, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OF THE EQUIPMENT IN RESPECT TO WHICH THE CLAIM IS MADE, OR AT THE ELECTION OF THIS COMPANY, THE REPAIR OR REPLACEMENT OF SUCH MATERIAL.** This Company shall not be liable for, and Purchaser assumes responsibility for, all personal injury and property damage resulting from the handling, possession, use or resale of the equipment. In no event shall this Company be liable for special, incidental or consequential damages, whether Purchaser's claim is in contract, negligence, strict liability or otherwise. Transportation charges for the return of material shall not be paid unless authorized in advance by this Company.

13. **ENTIRETY OF AGREEMENT** - These General Terms and Conditions set forth the entire agreement between parties, supersede any prior understandings, discussions and agreements, and shall take precedence over any terms and conditions submitted by Buyer, said terms and conditions being of no force or effect except with written consent of Company. No alteration or modification of these terms and conditions shall have any force, effect, or validity whatsoever unless it shall be in writing signed by this Company and shall state that it is intended to be effective as such alteration or modification.

14. **TERMS OF PAYMENT** - If the terms of payment as specified per the quotation are not met, interest will be charged on all past due amounts at the prevailing rate.

15. **INSPECTION** - The Buyer may inspect, or provide for inspection, of the finished equipment at the place of manufacture. Such inspection shall be so conducted as not to interfere unreasonably with the Seller's operations, and consequent approval or rejection shall be made before shipment of the equipment.

16. **PERMITS AND LICENSES** - Buyer shall procure, at his own expense, all permits and licenses required for this equipment.

17. **CLASSIFICATION** - Unless otherwise specified in writing and signed by the President of ThermTech, Inc., our equipment is designed with NEMA - 4 enclosures and is to be utilized in unclassified, non-hazardous, non-explosive areas.

18. **GOVERNING LAW** - This agreement shall be deemed to have been made in Kingwood, Texas, and shall be governed and interpreted by and under Texas law without regard to its conflicts of law provisions.